TECHNICAL SUPPORT DOCUMENT

Air Discharge Permit 23-3586
Air Discharge Permit Application CL-3147

Issued: June 22, 2023

WaferTech, LLC

SWCAA ID – 1978

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Southwest Clean Air Agency

TABLE OF CONTENTS

ABBREVIATIONS

List of Acronyms

ADP .... Air Discharge Permit
AP-42 .... Compilation of Emission Factors, AP-42, 5th Edition, Volume 1, Stationary Point and Area Sources – published by EPA
ASIL............. Acceptable Source Impact Level
BACT........... Best Available Control Technology
BART .... Best Available Retrofit Technology
CAM .... Compliance Assurance Monitoring
CAS.............. Chemical Abstracts Service registry (number)
CFR.............. Code of Federal Regulations
CMP............. Chemical Mechanical Planarization
CUP.............. Central Utility Plant
CVD............. Chemical Vapor Deposition
EPA.............. U.S. Environmental Protection Agency
EU .... Emission Unit
GEX .... General exhaust
GWP............. Greenhouse warming potential
HPM............. Hazardous Production Materials
IC .... Integrated Circuit
LAER........... Lowest achievable emission rate
Mfr .... Manufacturer
MSDS .... Material Safety Data Sheet
N................... Equivalent concentration (Eq/liter) or Normality
NOV............. Notice of Violation
NESHAP...... National Emission Standards for Hazardous Air Pollutants
NSPS............ New Source Performance Standard
ODEQ .... Oregon Department of Environmental Quality
PSD .... Prevention of Significant Deterioration
RACT........... Reasonably Available Control Technology
RCW .... Revised Code of Washington
SQER .... Small Quantity Emission Rate listed in WAC 173-460
Standard .... Standard conditions at a temperature of 68 °F (20 °C) and a pressure of 29.92 in Hg (760 mm Hg)
SWCAA....... Southwest Clean Air Agency
T-BACT....... Best Available Control Technology for toxic air pollutants
TDS.............. Total Dissolved Solids
WAC............ Washington Administrative Code
WDOE .... Washington State Department of Ecology

List of Units and Measures

°C .... Degrees Celsius
°F................. Degrees Fahrenheit
$\mu g/m^3$........... Microgram per cubic meter
µm .... Micrometer (10^{-6} meter)
acfm .... Actual cubic foot per minute
bhp .... Brake horsepower
Btu................ British Thermal Unit
dscfm............ Dry Standard cubic foot per minute
ft .... Foot
g/dscm .... Grams per dry Standard cubic meter
gal................. Gallon
gpm .... Gallon per minute
gr/dscf .... Grain per dry Standard cubic foot
kW .... Kilowatt
MMBtu .... Million British thermal unit
pH .... Negative log of the hydrogen ion concentration; $pH = -\log([H^+])$
ppmv .... Parts per million by volume
ppmvd .... Parts per million by volume, dry
ppmw .... Parts per million by weight
psig .... Pounds per square inch, gauge
rpm................ Revolution per minute
scfm .... Standard cubic foot per minute
tph .... Ton per hour
tpy .... Tons per year

List of Chemical Symbols, Formulas, and Pollutants

BF_3 .... Boron trifluoride
Br_2 .... Bromine gas
C_3H_8 .... Propane
CH_4.............. Methane
Cl_2 .... Chlorine gas
CO .... Carbon monoxide
CO_2.............. Carbon dioxide
CO_2e............ Carbon dioxide equivalent
F_2 .... Fluorine gas
H_2S .... Hydrogen sulfide
HAP .... Hazardous air pollutant listed pursuant to Section 112 of the Federal Clean Air Act
HBr.............. Hydrogen bromide or hydrobromic acid
HCl.............. Hydrogen chloride or hydrochloric acid
HF .... Hydrogen fluoride or hydrofluoric acid
Hg................. Mercury
HMDS .... Hexamethyldisilazane
HNO_3........... Nitric Acid
IPA .... Isopropyl alcohol or isopropanol
N_2O .... Nitrous oxide
NaOH .... Sodium hydroxide
NF_3................ Nitrogen trifluoride
NH_3 .... Ammonia
NMP N-methyl-2-pyrrolidone
NO_x .... Nitrogen oxides
O_2 .... Oxygen
O_3 .... Ozone
PGME .... Propylene glycol monomethyl ether
PGMEA .... Propylene glycol monomethyl ether acetate
PM .... Particulate Matter with an aerodynamic diameter 100 µm or less
PM_{10}.............. PM with an aerodynamic diameter 10 µm or less
$PM_{2.5}$ .... PM with an aerodynamic diameter 2.5 µm or less
SF_6 .... Sulfur hexafluoride
SO_2................ Sulfur dioxide
SO_x................ Sulfur oxides (includes SO_2)
TAP.............. Toxic air pollutant pursuant to Chapter 173-460 WAC
TEB.............. Triethyl borate
TEOS .... Tetraethyl orthosilicate
TGOC .... Total Gaseous Organic Carbon
VOC............. Volatile organic compound

1. FACILITY IDENTIFICATION

Applicant Name:	WaferTech, LLC
Applicant Address:	5509 NW Parker Street, Camas, WA 98607-9299
Facility Name:	WaferTech, LLC
Facility Address:	5509 NW Parker Street, Camas, WA 98607-9299
Contact Person:	Bryan Mirick, Environmental Engineer
SWCAA Identification:	1978
Primary Process:	Semiconductor Manufacturing
SIC/NAICS Code:	3674: Semiconductors and related devices 334413: Semiconductor devices manufacturing
Facility Classification:	Natural minor for criteria pollutants and HAP

2. FACILITY DESCRIPTION

WaferTech, LLC (WaferTech) produces integrated circuits (ICs) on eight-inch wafers using advanced Complementary Metal Oxide Semiconductor technology with circuit widths ranging from initial production at 0.35 micrometers (µm) down to less than 0.15 µm. These include digital logic, mixed-mode logic, and standard and embedded memory ICs. Such ICs are used in a variety of products – from desktop computers to automobiles to consumer electronics to communication equipment.

WaferTech produces ICs with state-of-the-art production tools in etch, implant, diffusion, chemical vapor deposition, ion implant, photolithography, and thin film departments. These operations are conducted in the integrated circuit fabrication facility.

WaferTech is also equipped with several support facilities that include wastewater treatment, ultrapure water, water recycling, process cooling water, steam generation, cryogenic gas, emergency power, air pollution control, chemical storage, and distribution operations.

The facility's emission units consist of hot water boilers, emergency generators, concentrator units, acid scrubbers and a Central Utility Plant scrubber.

3. CURRENT PERMITTING ACTION

This permitting action is in response to Air Discharge Permit (ADP) application number CL-3147, dated November 10, 2020, with additional information submitted on February 1, 2021, May 7, 2021, November 22, 2022, and March 16, 2023, requesting the following:

- Increase hydrogen fluoride (HF) emission limits from 0.27 tpy to 0.75 tpy and nitric acid (HNO_3) emission limits from 0.13 tpy to 0.35 tpy for the following units:
  - Acid Scrubber 1F1-SCR-01;
  - Acid Scrubber 1F1-SCR-02;
  - Acid Scrubber 1F1-SCR-03;
  - Acid Scrubber 1F1-SCR-04; and
  - Acid Scrubber 1F1-SCR-15;
- Decrease HF emission limit from 0.27 tpy to 0.088 tpy and HNO_3 emission limit from 0.13 tpy to 0.041 tpy for Acid Scrubbers 1F2-SCR-01 and 1F2-SCR-02 (combined); and
- Increase HF emission limit from 0.27 tpy to 0.57 tpy and HNO_3 emission limit from 0.13 tpy to 0.26 tpy for Acid Scrubbers 1P5-SCR-01 and 1P5-SCR-02 (combined).

WaferTech submitted an additional request March 14, 2022, requesting the following:

- Increase Volatile Organic Carbon (VOC) emission limits for oxidizers/concentrators 1F1-VOC-01, 1F1-VOC-02, 1F1-VOC-03, 1F1-VOC-04, 1F1-VOC-05, and 1F1-VOC-06 from 3.95 tons per year to 5.20 tons per year.
- Increase Isopropyl Alcohol (IPA) emission limits for oxidizers/concentrators 1F1-VOC-02, 1F1-VOC-04, 1F1-VOC-05, and 1F1-VOC-06 from 2.50 tons per year to 3.50 tons per year.

ADP 23-3586 will supersede ADP 19-3551 in its entirety.

4. PROCESS DESCRIPTION

4.a. Surface Preparation. The facility uses several methods to prepare the blank silicon wafers for processing (Fig. 1). Blank wafers may be cleaned with solvents or acids and physically or chemically altered.

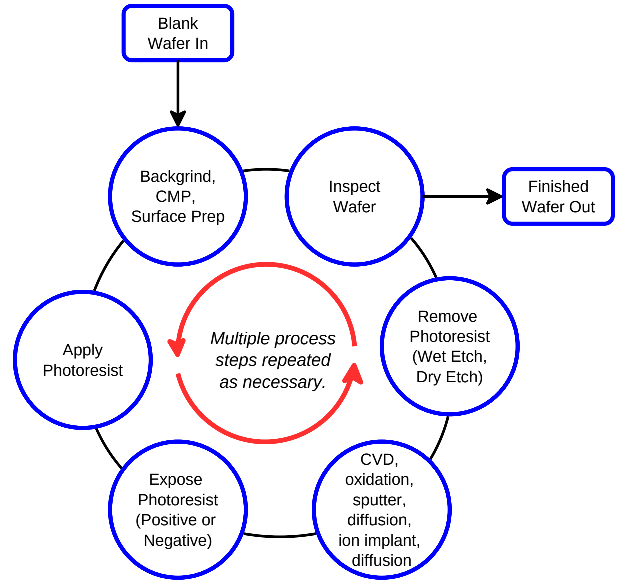

Fig. 1: Steps in the wafer processing cycle.

Backgrind. Wafers typically will go through a laminating or cleaning step before backgrinding begins. During the physical process of backgrinding, the wafer thickness is directly reduced using various grits of grinding wheels and grinding speed. The wafer is continuously washed in pure deionized water during the process.

Chemical Mechanical Planarization (CMP). CMP is a processing step that is used to flatten or smooth the wafer surface using chemical and physical means. CMP may also be used to flatten layers added to the wafer through other processes. It may also be used on films that cannot be etched by conventional means, such as wet etches or plasma processes. CMP uses an abrasive slurry with an automated rotating polishing pad. CMP may occur many times during the fabrication of the integrated circuit. It usually occurs immediately after film deposition, followed either by photolithography or another film deposition.

One of the main reasons for CMP is to improve the surface planarity (i.e., flatness) and allow for increased circuit density, improved wiring pitches, and make more advanced circuit designs possible.

4.b. Thin Film Application/Oxidation. Once the wafer has been prepared, a layer of metal oxide or other material is applied to the wafer. Using photolithography (see below), the chemical and physical characteristics of each layer can be manipulated to provide the desired electronic configuration. The wafer begins to have a vertical structure as each layer of material is applied or removed (via etching or other mechanisms). There are several techniques for applying layers to the wafer.

Thin Film Deposition. Thin film deposition is one of the most common fabrication processes. Films may be metals, semiconductors or insulators and are used as a temporary protective layer or to construct circuit or device components.

Chemical Vapor Deposition (CVD) is a thin film process used to produce high-purity, high-performance solid materials. During the CVD process, the wafer is exposed in a heated reaction chamber to one or more chemicals which react or decompose on the wafer to produce a desired effect. Gas is pumped into the chamber causing a reaction to take place of either depositing a thin film onto the wafer or growing a film on the wafer.

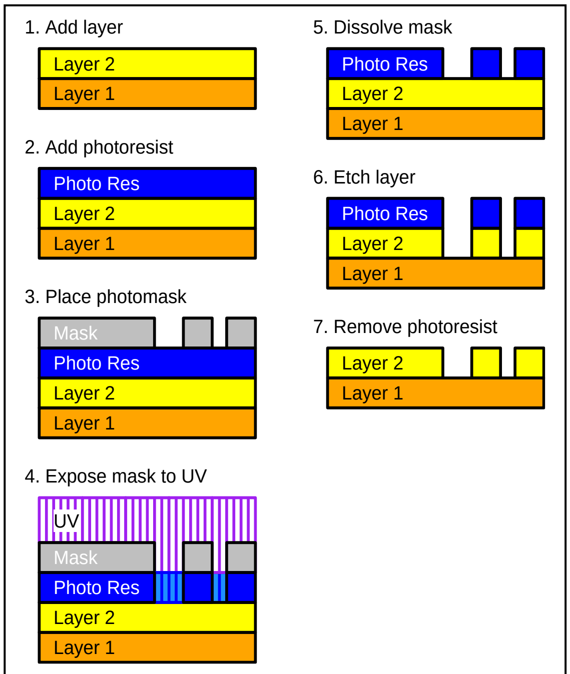

Fig. 2: Photolithography steps

Sputtering. Sputtering is the process of depositing a thin layer of metal on the wafer to manufacture interconnects, which are electrical conducting paths formed during the metallization process to allow for the electrical connections of the IC components. Interconnects are typically made from silicides and alloys made with aluminum.

The sputter process involves solid metal material being impacted by a high energy ion source. The process is performed in a vacuum chamber filled with argon gas. When the ions impact the metal, metal ions are ejected from the surface due to momentum transfer and are available for deposition on a substrate, such as a wafer. The wafer may be heated to improve adhesion of the metal ions.

Diffusion Process. The diffusion process is an intentional introduction of a controlled quantity of impurities onto the wafer to change the electric characteristics of the wafer; this is also called doping. The doped impurities cause a physical change in the crystalline structure of the silicon wafer. A carrier gas (typically nitrogen) is enriched with a dopant (e.g., boron, arsenic, phosphorus, phosphine, and diborane) and is pumped into a quartz furnace that contains the wafers. The chamber is heated to 1,652 °F (900 °C) causing the dopant particles to diffuse into the wafer.

Ion Implantation Process. Ion implantation, like diffusion, is a technique for introducing dopant atoms such as boron, phosphorus, arsenic, and antimony into the substrate of the wafer. Using arsine, phosphine, and boron trifluoride (BF_3) gases, the select dopant atoms are ionized and then electrostatically accelerated to a high energy to penetrate the wafer. When the ions hit the wafer, it causes physical and chemical changes and alters the wafer's electrochemical properties. The wafer is coated with a resist or a film layer that acts as a barrier to protect areas of the wafer where no implantation is desired. Hydrogen peroxide and isopropyl alcohol (IPA) may be used for surface conditioning.

4.c. Photolithography. After a material layer has been applied to the wafer, photolithography allows the layer to be patterned on a very small scale (Fig. 2). Photoresist is a thick viscous material that reacts to ultraviolet light. It is applied to a spinning wafer (spin coating) to provide a uniform thickness. Other chemicals may be present that help the photoresist to adhere to the wafer and the wafer may be heated to cure the photoresist.

Ultraviolet light is passed through a pattern (photomask) representing the circuit components of an integrated circuit onto the photoresist. Areas of the photoresist that are not obscured by the mask are exposed to the ultraviolet light, which causes a physical change in the photoresist allowing it to be removed in a solvent (positive photoresist). The exposed photoresist is then chemically or physically removed, and the underlying layer below is exposed. The underlying layer is then wet or dry etched (see below) to create a pattern in the layer. Finally, the remaining photoresist is mechanically or chemically removed, leaving only the etched layer on the surface of the wafer. This process may be repeated several times during wafer processing creating many layers. Acetone may be used for surface reconditioning.

4.d. Wet Etch and Dry Etch. Etching is a processing step used to remove material from the wafer surface; the removal may be patterned or unpatterned. WaferTech uses both wet and dry etching processes, each of which involve three steps:

- Dispersal of the etching compound;
- Etching the material from the wafer surface; and
- Removal of the by-products created during etching.

Patterned etching takes place in conjunction with photolithography. After exposing and developing the photoresist, the areas of the wafer that are not protected by the photoresist are etched away. In this way the pattern transfer is obtained. Unpatterned etching takes place over the entire wafer surface. It is used to remove masking layers such as photoresist, oxides, or nitrides, or used as a cleaning step. Wet etching uses liquid chemicals (acids, bases, and solvents) that react chemically with the wafer material to be removed. Dry etching uses plasma to remove material by chemical reaction, physical means, or a combination of the two.

5. EQUIPMENT/ACTIVITY IDENTIFICATION

5.a. Boilers. The Cleaver-Brooks fire tube boilers are in the Central Utility Plant and provide process hot water. Original specifications stated the boilers were rated at 24,409,090 Btu/hr input while burning natural gas at 1,000 Btu/ft^3, a gas density of 0.050 lb/scf, and 5 psig; SWCAA has used the value of 24.4 MMBtu/hr for these boilers, an energy density of 1,020 Btu/ft^3 and the same gas density.

Boiler #1. The boiler is 86.5% efficient, is equipped with a low NO_x burner, and is fired on natural gas only with a 10:1 turndown. The exhaust flow depends upon the number of boilers operating and is between 10,232 acfm (single boiler) and 30,696 acfm (all three boilers).

Boiler Manufacturer:	Cleaver-Brooks
Model Number:	CBLE 700.600.125W
Serial Number:	OL095883

Heat Rate:	24.4 MMBtu/hr
Stack Diameter:	3' (combined stack with Boilers #2 and #3)
Stack Height:	68' (combined stack with Boilers #2 and #3)
Stack Flow:	10,232–30,696 acfm (combined stack with Boilers #2 and #3)
Stack Temperature:	270 °F
40 CFR 60 Subpart Dc:	Yes
40 CFR 63 Subpart JJJJJJ:	No; natural gas-only boilers are exempt from requirements

Boiler #2. The boiler is 86.5% efficient, is equipped with a low NO_x burner, and is fired on natural gas only with a 10:1 turndown. The exhaust flow depends upon the number of boilers operating and is between 10,232 acfm (single boiler) and 30,696 acfm (all three boilers).

Boiler Manufacturer:	Cleaver-Brooks
Model Number:	CB LE 700.600.125W
Serial Number:	OL095884
Heat Rate:	24.4 MMBtu/hr
Stack Diameter:	3′ (combined stack with Boilers #1 and #3)
Stack Height:	68′ (combined stack with Boilers #1 and #3)
Stack Flow:	10,232–30,696 acfm (combined stack with Boilers #1 and #3)
Stack Temperature:	270 °F
40 CFR 60 Subpart Dc:	Yes
40 CFR 63 Subpart JJJJJJ:	No; natural gas-only boilers are exempt from requirements

Boiler #3. The boiler is 86.5% efficient, is equipped with a low NO_x burner, and is fired on natural gas with #2 fuel oil or biodiesel as a backup during natural gas curtailment with a 10:1 turndown. The exhaust flow depends upon the number of boilers operating and is between 10,232 acfm (single boiler) and 30,696 acfm (all three boilers).

Boiler Manufacturer:	Cleaver-Brooks
Model Number:	CB LE 700.600.125W
Serial Number:	OL095885
Heat Rate:	24.4 MMBtu/hr
Stack Diameter:	3' (combined stack with Boilers #1 and #2)
Stack Height:	68' (combined stack with Boilers #1 and #2)
Stack Flow:	10,232–30,696 acfm (combined stack with Boilers #1 and #2)
Stack Temperature:	270 °F
40 CFR 60 Subpart Dc:	Yes
40 CFR 63 Subpart JJJJJJ:	Yes

Boiler #4. The boiler is 86.5% efficient, is equipped with a low NO_x burner, and is fired on natural gas with #2 fuel oil or biodiesel as a backup during natural gas curtailment with a 10:1 turndown.

Boiler Manufacturer:	Cleaver-Brooks
Model Number:	CB LE 700.600.125W
Serial Number:	OL095886
Heat Rate:	24.4 MMBtu/hr
Stack Diameter:	3'
Stack Height:	68'
Stack Flow:	10,232 acfm
Stack Temperature:	270 °F
40 CFR 60 Subpart Dc:	Yes
40 CFR 63 Subpart JJJJJJ:	Yes

5.b. Emergency Generator Engines. The six Caterpillar emergency generator engines (m/n 3512B) are identical.

Emergency Generator Engine #1. The engine (s/n 5567-1) is rated at 2,032 bhp (1,500 kW) with a fuel consumption rate of 105.7 gal/hr of #2 fuel oil or biodiesel at 100% load. Each engine exhausts through a dedicated 1′ 2″ diameter stack at 10,220 acfm (mfr spec), 63′ above ground level. The exhaust temperature is estimated to be 922 °F (mfr spec). This unit is subject to 40 CFR 63 Subpart ZZZZ.

Emergency Generator Engine #2. The engine (s/n 5615-3) is rated at 2,032 bhp (1,500 kW) with a fuel consumption rate of 105.7 gal/hr of #2 fuel oil or biodiesel at 100% load. Each engine exhausts through a dedicated 1′ 2″ diameter stack at 10,220 acfm (mfr spec), 63′ above ground level. The exhaust temperature is estimated to be 922 °F (mfr spec). This unit is subject to 40 CFR 63 Subpart ZZZZ.

Emergency Generator Engine #3. The engine (s/n 5615-1) is rated at 2,032 bhp (1,500 kW) with a fuel consumption rate of 105.7 gal/hr of #2 fuel oil or biodiesel at 100% load. Each engine exhausts through a dedicated 1′ 2″ diameter stack at 10,220 acfm (mfr spec), 63′ above ground level. The exhaust temperature is estimated to be 922 °F (mfr spec). This unit is subject to 40 CFR 63 Subpart ZZZZ.

Emergency Generator Engine #4. The engine (s/n 5615-5) is rated at 2,032 bhp (1,500 kW) with a fuel consumption rate of 105.7 gal/hr of #2 fuel oil or biodiesel at 100% load. Each engine exhausts through a dedicated 1′ 2″ diameter stack at 10,220 acfm (mfr spec), 63′ above ground level. The exhaust temperature is estimated to be 922 °F (mfr spec). This unit is subject to 40 CFR 63 Subpart ZZZZ.

Emergency Generator Engine #5. The engine (s/n 5615-6) is rated at 2,032 bhp (1,500 kW) with a fuel consumption rate of 105.7 gal/hr of #2 fuel oil or biodiesel at 100% load. Each engine exhausts through a dedicated 1′ 2″ diameter stack at 10,220 acfm (mfr spec), 63′ above ground level. The exhaust temperature is estimated to be 922 °F (mfr spec). This unit is subject to 40 CFR 63 Subpart ZZZZ.

Emergency Generator Engine #6. The engine (s/n 5610) is rated at 2,032 bhp (1,500 kW) with a fuel consumption rate of 105.7 gal/hr of #2 fuel oil or biodiesel at 100% load. Each engine exhausts through a dedicated 1′ 2″ diameter stack at 10,220 acfm (mfr spec), 63′ above ground level. The exhaust temperature is estimated to be 922 °F (mfr spec). This unit is subject to 40 CFR 63 Subpart ZZZZ.

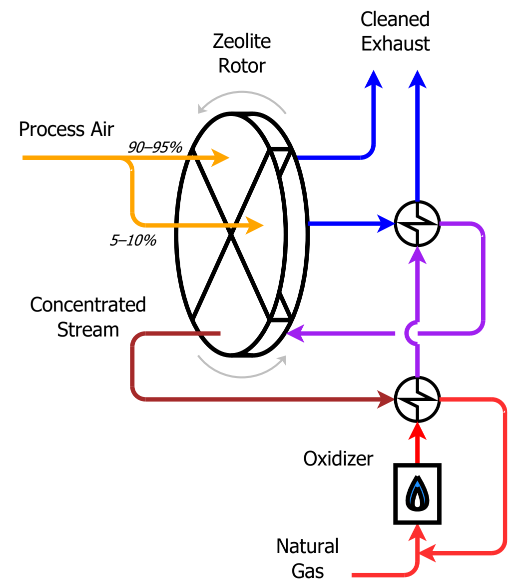

Fig. 3: Concentrator flow diagram

5.c. Zeolite Rotor Oxidizer/Concentrators. The Zeolite rotor oxidizer/concentrator units are manufactured by Munters-Zeol and are rated at 10,000 acfm (mfr spec) maximum flow. The air passes through the adsorption zone of a circular, rotating hydrophobic zeolite unit (Fig. 3). Process air from several parts of the facility is gathered into a header, where it is sent to the six oxidizer/concentrator units (Fig. 4). VOCs are adsorbed onto the media and cleaned process air is then discharged to the atmosphere. As the zeolite unit turns, the adsorbed portion of the unit is moved into the regeneration zone. A portion of the cleaned process air (~5–10%) is passed through a heat exchanger, then counter-current through the regeneration zone of the zeolite unit. The VOCs are desorbed from the zeolite and then pass through a second heat exchanger where the stream is heated to about 300 °F, before being oxidized with natural gas in an oxidizer

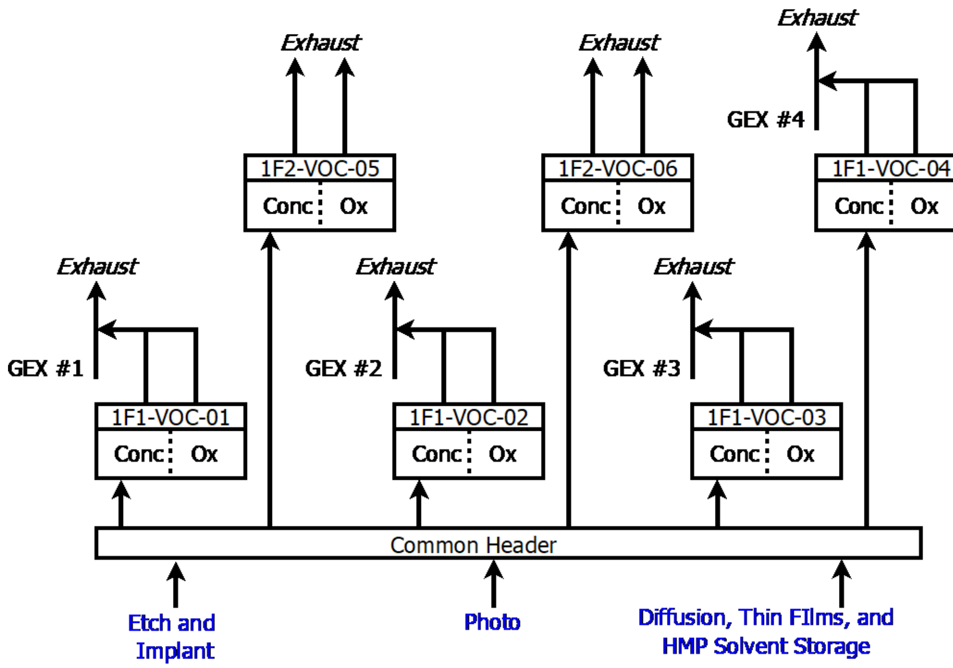

Fig. 4: Configuration of the six oxidizer/concentrators.

unit. The oxidizer provides heat to the two heat exchangers before discharging to the atmosphere. In units 1F1-VOC-01 through 1F1-VOC-04, the "cleaned exhaust" discharges from the rotor and the oxidizer are combined, in 1F2-VOC-05 and 1F2-VOC-06, they are separate.

Oxidizer/Concentrator 1F1-VOC-01.

Serial Number:	1900-110
Oxidizer Heat Rate:	1.5 MMBtu/hr
Oxidizer Temperature:	1,800 °F (max), 1,360–1,500 °F (normal)
Stack Diameter:	4′ 10″ (combined stack)
Stack Height:	100′ (combined stack)
Stack Flow:	10,000 acfm
Stack Temperature:	100 °F

Oxidizer/Concentrator 1F1-VOC-02.

Serial Number:	1900-111
Oxidizer Heat Rate:	1.5 MMBtu/hr
Oxidizer Temperature:	1,800 °F (max), 1,360–1,500 °F (normal)
Stack Diameter:	4′ 10″ (combined stack)
Stack Height:	100' (combined stack)
Stack Flow:	10,000 acfm
Stack Temperature:	100 °F

Oxidizer/Concentrator 1F1-VOC-03.

Serial Number:	1900-113
Oxidizer Heat Rate:	1.5 MMBtu/hr
Oxidizer Temperature:	1,800 °F (max), 1,360–1,500 °F (normal)
Stack Diameter:	4′ 10″ (combined stack)
Stack Height:	100′ (combined stack)
Stack Flow:	10,000 acfm
Stack Temperature:	100 °F

Oxidizer/Concentrator 1F1-VOC-04.

Serial Number:	1900-112
Oxidizer Heat Rate:	1.5 MMBtu/hr
Oxidizer Temperature:	1,800 °F (max), 1,360–1,500 °F (normal)
Stack Diameter:	4′ 10″ (combined stack)
Stack Height:	100′ (combined stack)
Stack Flow:	10,000 acfm
Stack Temperature:	100 °F

Oxidizer/Concentrator 1F2-VOC-05.

Serial Number:	1900-119
Oxidizer Heat Rate:	1.5 MMBtu/hr
Oxidizer Temperature:	1,800 °F (max), 1,360–1,500 °F (normal)
Stack Diameter:	1′ 2″ (oxidizer); 2′ 8″ (concentrator)

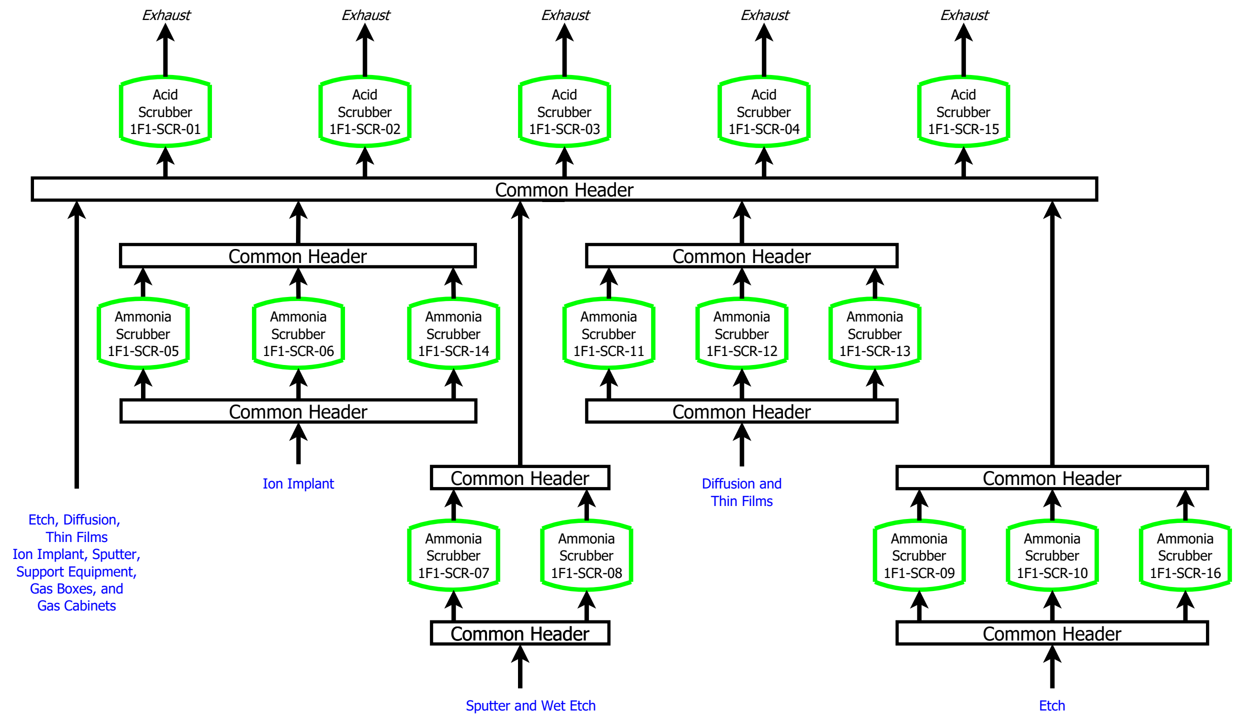

Fig. 5: Configuration of the F1 Acid and Ammonia Scrubbers.

Stack Height:	100′ (oxidizer); 100′ (concentrator)
Stack Flow:	2,600 acfm (oxidizer); 10,000 acfm (concentrator)
Stack Temperature:	800 °F (oxidizer); 75 °F (concentrator)

Oxidizer/Concentrator 1F2-VOC-06.

Serial Number:	1900-122
Oxidizer Heat Rate:	1.2 MMBtu/hr
Oxidizer Temperature:	1,800 °F (max), 1,360–1,500 °F (normal)
Stack Diameter:	1′ 2″ (oxidizer); 2′ 8‴ (concentrator)
Stack Height:	100′ (oxidizer); 100′ (concentrator)
Stack Flow:	2,600 acfm (oxidizer); 10,000 acfm (concentrator)
Stack Temperature:	800 °F (oxidizer); 75 °F (concentrator)

5.d. Fabrication Building, First Floor (F1), Acid and Ammonia Scrubbers. WaferTech operates five acid scrubbers, mostly for control of sulfuric acid, hydrochloric acid (HCl), and hydrofluoric acid (HF). All the scrubbers are manufactured by Ceilcote Air Pollution Control/Air-Cure Dynamics, Inc. and use a 50% solution of sodium hydroxide (NaOH) as a scrubbing medium to maintain a pH above 8.0. Each scrubber is designed for a 99% removal efficiency for HCl, phosphoric acid, and sulfuric acid gases and 98–99% removal efficiency of nitric acid gases. NO_X is generated either by the dissociation of HNO_3 during the process or due to a chemical reaction with the silicon wafers. In either case, it is not a result of combustion. The entrainment separator is designed for a 99% control of liquid droplets 10 µm and larger.

There are four headers that are controlled by sets of ammonia scrubbers that exhaust into a second set of four common headers. All the headers vent into a larger header that is controlled by the five acid scrubbers (Fig. 5).

Acid Scrubber 1F1-SCR-01.

Model Number:	HRP-108-60
Scrubber Type:	Cross flow
Stack Diameter:	3′ 10″
Stack Height:	96′
Stack Flow:	44,000 acfm (max); 32,500 acfm (normal)
Dimensions:	15′ in length, 11′ in height and 10′ in width

Acid Scrubber 1F1-SCR-02.

Model Number:	HRP-108-60
Scrubber Type:	Cross flow
Stack Diameter:	3′ 10″
Stack Height:	96′
Stack Flow:	44,000 acfm (max); 32,500 acfm (normal)
Dimensions:	15′ in length, 11′ in height and 10′ in width

Acid Scrubber 1F1-SCR-03.

Model Number:	HRP-108-60
Scrubber Type:	Cross flow
Stack Diameter:	3′ 10″
Stack Height:	96′
Stack Flow:	44,000 acfm (max); 32,500 acfm (normal)
Dimensions:	15′ in length, 11′ in height and 10′ in width

Acid Scrubber 1F1-SCR-04.

Model Number:	HRP-108-60
Scrubber Type:	Cross flow
Stack Diameter:	48″
Stack Height:	96′
Stack Flow:	44,000 acfm (max); 32,500 acfm (normal)
Dimensions:	15′ long, 11′ high, 10′ wide

Acid Scrubber 1F1-SCR-15.

Model Number:	SPT-132-84
Scrubber Type:	Cross Flow
Stack Diameter:	3′ 10″
Stack Height:	98′
Stack Flow:	50,000 acfm (normal)
Dimensions:	11′ diameter and 20′ high

Ammonia Scrubbers 1F1-SCR-07 and 1F1-SCR-08.

Ammonia Scrubbers 1F1-SCR-07 and 1F1-SCR-08 are designed for a flow rate of 1,250 acfm and the remaining ammonia scrubbers are designed for 2,500 acfm.

Ion Implant Header. This header is controlled by three scrubbers, Ammonia Scrubber 1F1-SCR-05, Ammonia Scrubber 1F1-SCR-06, and Ammonia Scrubber 1F1-SCR-14, which vent into a second common header, and finally into a third, larger header controlled by the acid scrubbers. These ammonia scrubbers are rated at 2,500 acfm.

Sputter and Wet Etch Header. This header is controlled by two scrubbers, Ammonia Scrubber 1F1-SCR-07 and Ammonia Scrubber 1F1-SCR-08, which vent into a second common header, and finally into a third, larger header controlled by the acid scrubbers. These ammonia scrubbers are rated at 1,250 acfm.

Diffusion and Thin Films Header. This header is controlled by three scrubbers, Ammonia Scrubber 1F1-SCR-11, Ammonia Scrubber 1F1-SCR-12, and Ammonia Scrubber 1F1-SCR-13, which vent into a second common header, and finally into a third, larger header controlled by the acid scrubbers. These ammonia scrubbers are rated at 2,500 acfm.

Etch Header. This header is controlled by three scrubbers, Ammonia Scrubber 1F1-SCR-09, Ammonia Scrubber 1F1-SCR-10, and Ammonia Scrubber 1F1-SCR-16, which vent into a second commons header, and finally into a third, larger header controlled by the acid scrubbers. These ammonia scrubbers are rated at 2,500 acfm.

Miscellaneous Processes and Equipment. Various additional processes, such as etch, diffusion, thin film, ion implant, and sputter, which do not discharge ammonia (NH_3) are vented into the common header and are controlled by the five acid scrubbers only. Also included are emissions from support equipment, gas boxes and gas cabinets.

5.e. Fabrication Building, Second Floor (F2), Acid and Ammonia Scrubbers. WaferTech operates two acid scrubbers, mostly for control of HCl and HF (Fig. 6). All the scrubbers are manufactured by Ceilcote Air Pollution Control/Air-Cure Dynamics, Inc. and use a 50% solution of NaOH as a scrubbing medium to maintain a pH above 8.0. Each scrubber has a 5′ bed depth of No. 2 Type K (3¼″) Tellerettes packing and an entrainment separator section consisting of chevron blades designed for 99% control of liquid droplets of 10 µm and larger. NO_X is generated either by the dissociation of HNO_3 during the process or due to a chemical reaction with the silicon wafers. In either case, it is not a result of combustion. Each scrubber recirculating system maintains the scrubber liquor flow rate at 150 gpm for each of the scrubbers.

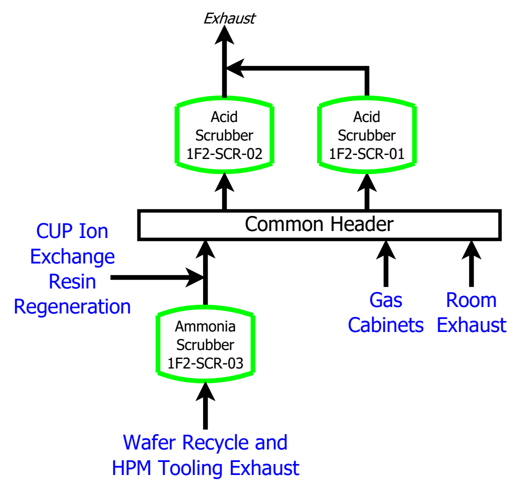

Fig. 6: Configuration of the F2 Acid and Ammonia Scrubbers.

The wafer recycle and Hazardous Production Materials (HPM) tooling exhaust first vent through Ammonia Scrubber 1F2-SCR-03 prior to venting to the common header. The common header includes vent streams from room exhaust, gas cabinet ventilation, and Ammonia Scrubber 1F2-SCR-03.

Acid Scrubber 1F2-SCR-01.

Model Number:	HRP-68-60
Scrubber Type:	Cross Flow
Exhaust Flow Rate:	18,500 acfm (maximum through common stack)
Dimensions:	14′ 6″ long, 11′ high, and 6′ wide
Stack Diameter:	2′ 11″ (common stack between 1F2-SCR-01 and 1F2-SCR-02)
Stack Height:	96′ (common stack between 1F2-SCR-01 and 1F2-SCR-02)
Stack Temperature:	55 °F

Acid Scrubber 1F2-SCR-02.

Model Number:	HRP-68-60
Scrubber Type:	Cross Flow
Exhaust Flow Rate:	18,500 acfm (maximum through common stack)
Dimensions:	14′ 6″ long, 11′ high, and 6′ wide
Stack Diameter:	2′ 11″ (common stack between 1F2-SCR-01 and 1F2-SCR-02)
Stack Height:	96′ (common stack between 1F2-SCR-01 and 1F2-SCR-02)
Stack Temperature:	55 °F

Ammonia Scrubber 1F2-SCR-03. This scrubber controls NH_3 emissions from wafer recycle and HPM tool exhaust prior to venting into the common header. The scrubber is rated at 4,200 acfm.

5.f. Fabrication Building, Fifth Floor (P5) Acid Scrubbers. WaferTech operates two acid scrubbers, mostly for control of HCl and HF (Fig. 7). All the scrubbers are manufactured by Ceilcote Air Pollution Control/Air-Cure Dynamics, Inc. and use a 50% solution of NaOH as a scrubbing medium to maintain a pH above 8.0. The entrainment separator is designed for a 99% control of liquid droplets 10 µm and larger. NO_X is generated either by the dissociation of HNO_3 during the process or due to a chemical reaction with the silicon wafers. In either case, it is not a result of combustion. Although there is no ammonia scrubber associated with the 1P5 acid scrubbers, some NH_3 emissions have been determined through testing.

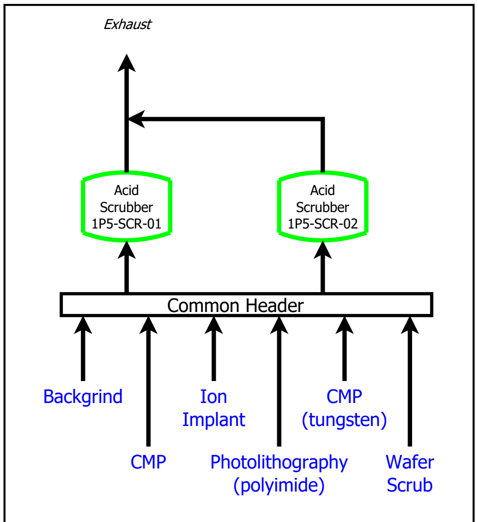

Fig. 7: Configuration of the P5 Acid Scrubbers.

Acid Scrubber 1P5-SCR-01. Scrubber 1P5-SCR-01 has #2 Tellerette packing to a bed depth of 5′ of and an entrainment separator section consisting of chevron blades. The scrubber recirculating system maintains the scrubber liquor flow rate at 150 gpm. This scrubber operates in parallel with Acid Scrubber 1P5-SCR-02 and exhausts through a common exhaust stack.

Model Number:	HRP-68-60
Scrubber Type:	Cross flow
Dimensions:	14′ 6″ in length, 11′ in height and 6′ in width
Stack Diameter:	3′ 4″ (common stack between 1P5-SCR-01 and 1P5-SCR-02)
Stack Height:	98′ (common stack between 1P5-SCR-01 and 1P5-SCR-02)
Design Flow Rate:	28,000 acfm (maximum through common stack)
Exhaust Flow Rate:	18,000 acfm (common stack between 1P5-SCR-01 and 1P5-SCR-02)
Stack Temperature:	65 °F

Acid Scrubber 1P5-SCR-02. Scrubber 1P5-SCR-02 has #2 Tellerette packing to a bed depth of 5′ and an entrainment separator section consisting of chevron blades. The scrubber recirculating system maintains the scrubber liquor flow rate at 150 gpm. This scrubber operates in parallel with Acid Scrubber 1P5-SCR-01 and exhausts through a common exhaust stack.

Model Number:	HRP-68-60
Scrubber Type:	Cross flow
Dimensions:	14′ 6″ in length, 11′ in height and 6′ in width
Stack Diameter:	3′ 4″ (common stack between 1P5-SCR-01 and 1P5-SCR-02)
Stack Height:	98′ (common stack between 1P5-SCR-01 and 1P5-SCR-02)
Design Flow Rate:	28,000 acfm (maximum through common stack)
Exhaust Flow Rate:	18,000 acfm (common stack between 1P5-SCR-01 and 1P5-SCR-02)
Stack Temperature:	65 °F

5.g. <u>Central Utility Plant Scrubber 1C1-SCR-01</u>. The scrubber is a packed scrubbing tower manufactured by Metpro Duall that is rated at 35 acfm; water is the scrubbing medium. The recirculation system maintains scrubber liquor flow rate at about 5 gpm. The scrubber is designed for a minimum of 90% removal efficiency of HCl. The exhaust from this scrubber has an output of 35 acfm and 67 °F through a 1′ diameter stack, 8′ above ground level.

5.h. <u>Insignificant Emission Units</u>. The following pieces of facility equipment have been determined to have insignificant emissions and are not registered with SWCAA as emission units:

- Five Tetratec filters control emissions from the exhaust of the facility vacuum system used for housekeeping and cleanup prior to discharging to the general exhaust system. According to the manufacturer, the filters have a 99.9% efficiency for the removal of 1 µm size particles and larger.

- Two cooling towers operate at 2,100 gpm using a combination of city and makeup water; these towers typically only operate in the winter months. There are at least four cycles with an assumed total dissolved solids (TDS) of 155 ppm (620 ppm total). Using a 0.002% drift rate (assumed worst case from AP-42), a solids density of 2.5 g/cm^3, AP-42 emission calculations for PM, guidance for PM_{10} and $PM_{2.5}$ calculations (see Section 6.f), and assuming 8,760 hr/yr operation the following rates were determined for a single cooling tower:

Pollutant	Emission Factors (lb/hr)	PTE Emissions (tpy)
TSP/PM_{30}	0.013	0.057
PM_{10}	0.012	0.053
$PM_{2.5}$	0.000066	0.00029

- Four wastewater scrubbers, Scrubbers 1T1-FSTS-01-SCRB, 1T1-FSTS-02-SCRB, 1T1-FSTS-03-SCRB and Scrubber 1T1-HFTS-02-FS01 can operate up to 8,760 hr/yr. The first three scrubbers discharge to a common stack, while the last scrubber discharges to a dedicated stack. Emissions are considered negligible, based on source test data, performed on November 5, 2007, shown below:

Pollutant	Emission Factors (lb/hr)	PTE Emissions (tpy)
1T1-FSTS-01/02/03-SCRB		
hydrochloric acid [7647-01-1]	<0.0001	4.4×10^{-4}
fluorides (as HF) [7664-39-3]	<0.0002	8.8×10^{-4}
nitric acid [7697-37-2]	<0.0002	8.8×10^{-4}
1T1-HFTS-02-FS01		
hydrochloric acid [7647-01-1]	<0.0001	4.4×10^{-4}
fluorides (as HF) [7664-39-3]	<0.0005	0.0022
nitric acid [7697-37-2]	<0.0003	0.0013

- The Emergency Smoke Purging System is designed to automatically discharge smoke and fumes from the building in the event of an emergency through ten discharge points on the roof. Because this is an emergency system, SWCAA does not consider the system to be an emission unit. However, in the event of a discharge, WaferTech would be required to notify SWCAA and may be required to provide additional information as to the nature of the emissions.

5.i. Equipment/Activity Summary.

EU No.	Generating Equipment/Activity	Control Equipment
1	Boiler #1 (1C1-HWB-01), Cleaver-Brooks	Low NO_x Burner and Natural Gas
2	Boiler #2 (1C1-HWB-02), Cleaver-Brooks	Low NO_x Burner and Natural Gas
3	Boiler #3 (1C1-HWB-03), Cleaver-Brooks	1) Low NO_x Burner and Natural Gas; or 2) Ultralow Sulfur (≤15 ppmw) Fuels (#2 Fuel Oil and Biodiesel)
4	Boiler #4 (1C1-HWB-04), Cleaver-Brooks	1) Low NO_x Burner and Natural Gas; or 2) Ultralow Sulfur (≤15 ppmw) Fuels (#2 Fuel Oil and Biodiesel)

EU No.	Generating Equipment/Activity	Control Equipment
5	Emergency Generator Engine #1, Caterpillar	Ultralow Sulfur (≤15 ppmw) Fuels (#2 Fuel Oil and Biodiesel)
6	Emergency Generator Engine #2, Caterpillar	Ultralow Sulfur (≤15 ppmw) Fuels (#2 Fuel Oil and Biodiesel)
7	Emergency Generator Engine #3, Caterpillar	Ultralow Sulfur (≤15 ppmw) Fuels (#2 Fuel Oil and Biodiesel)
8	Emergency Generator Engine #4, Caterpillar	Ultralow Sulfur (≤15 ppmw) Fuels (#2 Fuel Oil and Biodiesel)
9	Emergency Generator Engine #5, Caterpillar	Ultralow Sulfur (≤15 ppmw) Fuels (#2 Fuel Oil and Biodiesel)
10	Emergency Generator Engine #6, Caterpillar	Ultralow Sulfur (≤15 ppmw) Fuels (#2 Fuel Oil and Biodiesel)
11	Etch, Thin Films, Photo, Diffusion and Solvent Storage	Oxidizer/Concentrator 1F1-VOC-01, Munters-Zeol
12	Etch, Thin Films, Photo, Diffusion and Solvent Storage	Oxidizer/Concentrator 1F1-VOC-02, Munters-Zeol
13	Etch, Thin Films, Photo, Diffusion and Solvent Storage	Oxidizer/Concentrator 1F1-VOC-03, Munters-Zeol
14	Etch, Thin Films, Photo, Diffusion and Solvent Storage	Oxidizer/Concentrator 1F1-VOC-04, Munters-Zeol
15	Etch, Thin Films, Photo, Diffusion and Solvent Storage	Oxidizer/Concentrator 1F2-VOC-05, Munters-Zeol
16	Etch, Thin Films, Photo, Diffusion and Solvent Storage	Oxidizer/Concentrator 1F2-VOC-06, Munters-Zeol
17	Etch, Diffusion, Thin Films, Ion Implant, Sputter, Support Equipment, Gas Boxes, and Gas Cabinets	Acid Scrubbers 1F1-SCR-01, 1F1-SCR-02, 1F1-SCR-03, 1F1-SCR-04, and 1F1 SCR-15
18	Ion Implant	Ammonia Scrubbers 1F1-SCR-05, 1F1 SCR-06, and 1F1-SCR-14 and Acid Scrubbers 1F1-SCR-01, 1F1-SCR-02, 1F1-SCR-03, 1F1-SCR-04, and 1F1 SCR-15
19	Sputter and Wet Etch	Ammonia Scrubbers 1F1-SCR-07 and 1F1-SCR-08 and Acid Scrubbers 1F1 SCR-01, 1F1-SCR-02, 1F1-SCR-03, 1F1-SCR-04, and 1F1 SCR-15
20	Diffusion and Thin Films	Ammonia Scrubbers 1F1-SCR-11, 1F1 SCR-12, and 1F1-SCR-13 and Acid Scrubbers 1F1-SCR-01, 1F1-SCR-02, 1F1-SCR-03, 1F1-SCR-04, and 1F1 SCR-15

EU No.	Generating Equipment/Activity	Control Equipment
21	Etch	Ammonia Scrubbers 1F1-SCR-09, 1F1 SCR-10, and 1F1-SCR-16 and Acid Scrubbers 1F1-SCR-01, 1F1-SCR-02, 1F1-SCR-03, 1F1-SCR-04, and 1F1 SCR-15
22	Backgrind, CMP, Ion Implant, Photolithography, Polymide, CMP (tungsten), and Wafer Scrub	Acid Scrubbers 1P1-SCR-01 and 1P1-SCR-02
23	Room exhaust and Gas Cabinets	Acid Scrubbers 1F2-SCR-01 and 1F2-SCR-02
24	Wafer Recycle and HPM Tool exhaust	Acid Scrubbers 1F2-SCR-01 and 1F2-SCR-02 and Ammonia Scrubber 1F2-SCR-03
25	HCl Tank	Central Utility Plant (CUP) Scrubber 1C1-SCR-01
26	Cooling Towers	Mist Eliminators

6. EMISSIONS DETERMINATION

Emissions to the ambient atmosphere from the facility and from actions proposed in ADP Application CL-3147, consist of nitrogen oxides (NO_x), carbon monoxide (CO), volatile organic compounds (VOC), particulate matter (PM), sulfur dioxide (SO_2), toxic air pollutants (TAPs), and HAPs.

6.a. Boilers #1, #2, #3, and #4, natural gas. All the boilers have the same type of burner for burning natural gas and are operated in a similar fashion. Emission factors for natural gas are:

Pollutant	Emission Factors lb/MMcf	Emission Factors lb/hr*	PTE tpy	Source
NO_x	37.2	0.890	3.898	Mfr Data (30 ppmv NO_x)
CO	37.7	0.902	3.950	Mfr Data (50 ppmv CO)
VOC (as C_3H_8)	15.8	0.379	1.658	Mfr Data (13.33 ppmv VOC)
PM	10.2	0.244	1.069	Mfr Data (0.010 lb/MMBtu)
PM_{10}	10.2	0.244	1.069	Assumed equal to PM
$PM_{2.5}$	10.2	0.244	1.069	Assumed equal to PM
SO_2	0.6	0.0144	0.0629	AP-42 §1.4 (7/1998)
CO_2e	120,100.	2,860.	12,584.	40 CFR 98†
benzene [71-43-2]	0.00210	0.0000502	0.000220	AP-42 §1.4 (7/1998)
formaldehyde [50-00-0]	0.0750	0.00179	0.00786	AP-42 §1.4 (7/1998)
* The calculation assumes maximum fuel rate of boiler at 24.4 MMBtu/hr.				

Pollutant	Emission Factors lb/MMcf	Emission Factors lb/hr*	PTE tpy	Source
† The CO_2e emission factor is derived from 40 CFR 98 Subpart C (11/29/2013) with base factors of 117.0 lb/MMBtu CO_2, 0.05512 lb/MMBtu CH_4, and 0.0657 lb/MMBtu N_2O, including by the greenhouse warming potential (GWP) multipliers of CO_2=1, CH_4=25, and N_2O=298 and fuel heat content of 1026 Btu/scf.				

The above emission factors were used for modeling and to establish PTE and are used to determine annual emissions. If recent source test data is available, the source test data may be used in lieu of the above factors. Note that CO_2e factors are provided for informational purposes only as there are no requirements specified in the ADP.

6.b. Boilers #3 and #4, fuel oil. These boilers have additional burners capable of burning liquid fuel, namely #2 fuel oil or biodiesel, and are operated in a similar fashion. SWCAA assumes that the emission characteristics of biodiesel are identical to #2 fuel oil[1]. Emission factors for fuel oil are:

Pollutant	Emission Factors lb/1000 gal	Emission Factors lb/hr*	PTE tpy	Source
NO_x	25.1	4.38	3.112	Mfr Data (140 ppmv NO_x)
CO	9.83	1.71	1.216	Mfr Data (90 ppmv CO)
VOC (as C_3H_8)	3.44	0.599	0.425	Mfr Data (20 ppmv VOC)
PM	3.50	0.610	0.433	Mfr Data (0.025 lb/MMBtu PM)
PM_{10}	3.50	0.610	0.433	Assumed equal to PM
$PM_{2.5}$	3.50	0.610	0.433	Assumed equal to PM
SO_2	0.216	0.0382	0.0271	Mass Balance†
CO_2e	22,580.	3,990.	2,834.	40 CFR 98‡

* The calculation assumes maximum fuel rate of boiler at 24.4 MMBtu/hr.

† The calculation assumes that the liquid fuel (#2 fuel oil or biodiesel) properties are 15 ppmw S, 7.206 lb/gal density, and 138,000 Btu/gal.

‡ The CO_2e emission factor is derived from 40 CFR 98 Subpart C (11/29/2013) with base factors of 163.1 lb/MMBtu CO_2, 0.1653 lb/MMBtu CH_4, and 0.3942 lb/MMBtu N_2O, including the GWP multipliers of CO_2=1, CH_4=25, and N_2O=298 and fuel heat content of 0.138 MMBtu/gal. The 40 CFR 98 entry for biodiesel assumes B100, not B5.

The above emission factors were used for modeling and to establish PTE and are used to determine annual emissions. If recent source test data is available, the source test data may be used in lieu of the above factors. Note that CO_2e factors are provided for informational purposes only as there are no requirements specified in the ADP.

[1] According to the US Energy Information Administration, B100 biodiesel (100% biodiesel) has a heat content of 127,600 Btu/gal versus 138,000 Btu/gal for #2 fuel oil. B5 biodiesel would have approximately 137,480 Btu/gal, hence the assumption that the fuel is equivalent to #2 fuel oil. SWCAA assumes that the boiler emissions characteristics while burning B5 biodiesel are comparable with #2 fuel oil. "U.S. Energy Information Administration - EIA - Independent Statistics and Analysis." *Monthly Energy Review*. U.S. EIA, 28 July 2015. Web.

6.c. Emergency Generator Engines #1 through #6. All the engines are identically configured and can burn #2 fuel oil or biodiesel. As with the boilers, SWCAA assumes that the emission characteristics of biodiesel are identical to #2 fuel oil. Emission factors are:

Pollutant	Emission Factors		PTE *	Source
	g/hr	lb/hr	tpy	
NO_x	20,208.	44.55	4.455	Mfr Data/CL-1277 (10/14/1996)
CO	5,263.	11.60	1.160	Mfr Data/CL-1277 (10/14/1996)
VOC (as C_3H_8)	856.	1.887	0.189	Mfr Data/CL-1277 (10/14/1996) †
PM	592.	1.305	0.131	Mfr Data/CL-1277 (10/14/1996)
PM_{10}	592.	1.305	0.131	Assumed equal to PM
$PM_{2.5}$	592.	1.305	0.131	Assumed equal to PM
SO_2	—	0.0228	0.0023	Mass Balance ‡
CO_2e	—	2,369.	236.9	40 CFR 98 #

* PTE assumes a maximum operation of 200 hr/yr. Emergency operation is not limited.

† The original manufacturer factor was 699 g/hr VOC as carbon, which is equivalent to 856 g/hr VOC as C_3H_8.

‡ The calculation assumes that the liquid fuel (#2 fuel oil or biodiesel) properties are 15 ppmw S, and 7.206 lb/gal density.

\# The CO_2e emission factor is derived from 40 CFR 98 Subpart C (11/29/2013) with base factors of 163.1 lb/MMBtu CO_2, 0.1653 lb/MMBtu CH_4, and 0.3942 lb/MMBtu N_2O, including the GWP multipliers of CO_2=1, CH_4=25, and N_2O=298 and fuel heat content of 0.138 MMBtu/gal. The 40 CFR 98 entry for biodiesel assumes B100, not B5.

The above emission factors were used for modeling and to establish a short-term PTE and are used to determine annual emissions. If recent source test data is available, the source test data may be used in lieu of the above factors. Note that CO_2e factors are provided for informational purposes only as there are no requirements specified in the ADP.

6.d. Oxidizer/Concentrators 1F1-VOC-01, 1F1-VOC-02, 1F1-VOC-03, 1F1-VOC-04, 1F2-VOC-05, and 1F2-VOC-06. Several areas of the facility, including etch, thin film, photolithography, diffusion and HPM area, vent to a common header that is controlled by the six oxidizer/concentrator units. Four of the oxidizer/concentrator units (01 through 04) have a combined common stack for the oxidizer and concentrator, while two units (05 and 06) have individual stacks for the oxidizer and concentrator. Five of the oxidizer units (01 through 05) are rated at 1.5 MMBtu/hr and one (06) is rated at 1.2 MMBtu/hr. Up to 95% of the airflow into the oxidizer/concentrator units is passed through the concentrator for control; the remaining 5–10% of the airflow is used to remove VOC from the concentrator to be burned in the oxidizer with supplemental natural gas. For the oxidizer burning natural gas and controlling NO_x, CO, and VOC, the emission factors are given below:

1F1-VOC-01, 1F1-VOC-02, 1F1-VOC-03, 1F1-VOC-04, and 1F2-VOC-05				
Pollutant	Emission Factors		PTE tpy	Source
	lb/MMBtu	lb/hr *		
NO_x	—	0.339	1.489	WaferTech Engr Judgement
CO	—	0.748	3.285	WaferTech Engr Judgement

1F1-VOC-01, 1F1-VOC-02, 1F1-VOC-03, 1F1-VOC-04, and 1F2-VOC-05				
Pollutant	Emission Factors		PTE tpy	Source
	lb/MMBtu	lb/hr *		
VOC (as IPA)	—	1.19	5.20	WaferTech Engr Judgement
PM	0.00745	0.0112	0.0491	AP-42 §1.4 (7/1998)
PM_{10}	0.00745	0.0112	0.0491	Assumed equal to PM
$PM_{2.5}$	0.00745	0.0112	0.0491	Assumed equal to PM
SO_2	0.000588	0.00088	0.00386	AP-42 §1.4 (7/1998)
CO_2e	117.1	175.6	769.	40 CFR 98 †
benzene [71-43-2]	2.06×10^{-6}	3.09×10^{-6}	1.35×10^{-5}	AP-42 §1.4 (7/1998)
ethanolamine [141-43-5]	—	0.057**	0.250	SWCAA BACT Limit
formaldehyde [50-00-0]	7.35×10^{-5}	1.10×10^{-4}	4.82×10^{-4}	AP-42 §1.4 (7/1998)
isopropanol [67-63-0], 1F1-VOC-01, 1F1-VOC-02, 1F1-VOC-03, 1F1-VOC-04, 1F2-VOC-05	—	0.802**	3.500	SWCAA BACT Limit

* The calculation assumes maximum fuel rate of the oxidizer at 1.5 MMBtu/hr.

† The CO_2e emission factor is derived from 40 CFR 98 Subpart C (11/29/2013) with base factors of 117.0 lb/MMBtu CO_2, 0.05512 lb/MMBtu CH_4, and 0.0657 lb/MMBtu N_2O, including by the greenhouse warming potential (GWP) multipliers of CO_2=1, CH_4=25, and N_2O=298 and fuel heat content of 1026 Btu/scf.

** Ethanolamine and isopropanol emission factors are back calculated from permit limits and the maximum intended operation of 8,760 hours per year

Oxidizer/Concentrator 1F2-VOC-06 is rated at 1.2 MMBtu/hr and the oxidizer and concentrator sections exhaust through separate stacks. Although this unit slightly smaller, previous permitting actions have established the same emission rates for NO_x and CO as the larger units. For the oxidizer burning natural gas and controlling NO_x, CO, and VOC, the emission factors are given below:

1F2-VOC-06				
Pollutant	Emission Factors		PTE tpy	Source
	lb/MMBtu	lb/hr *		
NO_x	—	0.34	1.489	WaferTech Engr Judgement
CO	—	0.75	3.285	WaferTech Engr Judgement
VOC (as IPA)	—	1.19	5.20	WaferTech Engr Judgement
PM	—	0.00894	0.0392	AP-42 §1.4 (7/1998)
PM_{10}	—	0.00894	0.0392	Assumed equal to PM
$PM_{2.5}$	—	0.00894	0.0392	Assumed equal to PM
SO_2	0.000588	0.00071	0.0031	AP-42 §1.4 (7/1998)
CO_2e	117.1	140.5	615.	40 CFR 98 †
benzene [71-43-2]	2.06×10^{-6}	2.47×10^{-6}	1.08×10^{-5}	AP-42 §1.4 (7/1998)

1F2-VOC-06				
	Emission Factors		PTE	
Pollutant	lb/MMBtu	lb/hr *	tpy	Source
ethanolamine [141-43-5]	—	0.0570**	0.2500	SWCAA BACT Limit
formaldehyde [50-00-0]	7.35×10^{-5}	8.85×10^{-5}	3.86×10^{-4}	AP-42 §1.4 (7/1998)
isopropanol [67-63-0]	—	0.80**	3.50	SWCAA BACT Limit

* The calculation assumes maximum fuel rate of the oxidizer at 1.2 MMBtu/hr.

† The CO_2e emission factor is derived from 40 CFR 98 Subpart C (11/29/2013) with base factors of 117.0 lb/MMBtu CO_2, 0.05512 lb/MMBtu CH_4, and 0.0657 lb/MMBtu N_2O, including by the greenhouse warming potential (GWP) multipliers of CO_2=1, CH_4=25, and N_2O=298 and fuel heat content of 1026 Btu/scf.

** Ethanolamine and isopropanol emission factors are back calculated from permit limits and the and maximum intended operation of 8,760 hours per year

The above emission factors were used for modeling and to establish PTE and are used to determine annual emissions. If recent source test data or other information supporting a different determination method is available, it may be used in lieu of the above factors. Note that CO_2e factors are provided for informational purposes only as there are no requirements specified in the ADP.

The following table is provided for informational purposes and represents the types and quantities of TAPs emitted by the Oxidizer/Concentrators or listed in historical permitting actions. Included is the anticipated control efficiency of the Oxidizer/Concentrators for the pollutant. Actual emissions will vary from year to year and may exceed the quantities listed below; however, it is not expected that the SQER will be exceeded.

Oxidizers/Concentrators, combined				
Pollutant	Estimated Control Efficiency	Type *	SQER lb/yr	PTE lb/yr †
acetone [67-64-1]	95%	TAP	43,748	198
n-butyl acetate [123-86-4]	95%	TAP	43,748	44
n-butyl alcohol [71-36-3]	95%	TAP	43,748	—
catechol [120-80-9]	95%	TAP/HAP	10,500	327
cresol (all isomers) [1319-77-3]	95%	TAP/HAP	10,500	1
ethanol [64-17-5]	95%	TAP	43,748	4
methanol [67-56-1]	95%	TAP/HAP	43,748	3
methyl n-amyl ketone [110-43-0]	95%	TAP	43,748	228
propylene glycol monomethyl ether [107-98-2]	95%	TAP	43,748	4,835
phosphine [7803-51-2]	0%	TAP/HAP	175	29
triethylborate (TEB) [150-46-9]	95%	TAP	175	15

Oxidizers/Concentrators, combined				
Pollutant	**Estimated Control Efficiency**	**Type** *	**SQER lb/yr**	**PTE lb/yr** †
* Any pollutant listed as "VOC only" is not speciated and would be included in the general VOC Limit of the Oxidizer/Concentrator. † Pollutants listed with zero emissions represent a situation where the pollutant was emitted in the past but may or may not be emitted in the future.				

The control efficiency for VOC emissions is estimated by the manufacturer (and has been specified in previous permitting actions) as 95%. WaferTech emits a variety of VOCs that are controlled by the oxidizer/concentrator units, some of which are TAPs, HAPs, or simply VOCs (neither TAPs nor HAPs). For those chemicals used by WaferTech for which no source testing is performed, mass balance will be used, assuming a 95% control, to calculate emissions to the ambient air. Unless specified above, per equipment manufacturer guidance, or determined by performing a source test, all other pollutants are assumed to have no control by the Oxidizers/Concentrators.

6.e. Fabrication Buildings (F1, F2, and P5) Acid and Ammonia Scrubbers. The Acid Scrubbers in the Fabrication Building. Floors 1 and 2 (F1 and F2) control emissions from common headers, which are discharged into by one or more ammonia scrubbers from several other headers. The Fabrication Building and Penthouse Floor 5 (P5) acid scrubbers do not include any ammonia scrubbers. SWCAA has established emission limits on the acid scrubbers for several pollutants. The short-term limits (ppm) are the same for all the acid scrubbers. In addition to the amount that may be produced via combustion, NO_x is also produced in the processes due to the dissociation of HNO_3 involving NF_3 and N_2O [2].

Using the assumed airflow for each acid scrubber (as measured from the individual or combined stack), the following emission factors are determined:

Acid Scrubbers 1F1-SCR-01, 1F1-SCR-02, 1F1-SCR-03, and 1F1-SCR-04				
Pollutant	**Emission Factor**		**PTE**	**Source**
	ppmvd	**lb/hr***	**tpy**	
NO_x	0.868	0.2739	1.200	SWCAA BACT Limit
ammonia [7664-41-7]	2.44	0.2847	1.247	SWCAA BACT Limit
chlorine (as Cl_2) [7782-50-5]	0.0700	0.03400	0.150	SWCAA BACT Limit
fluorides (as HF) [7664-39-3]	1.25	0.1713	0.750	SWCAA BACT Limit
hydrochloric acid [7647-01-1]	0.420	0.1049	0.460	SWCAA BACT Limit
nitric acid [7697-37-2]	0.184	0.07944	0.348	SWCAA BACT Limit

[2] Based on August 13, 1997 memo from WaferTech.

Acid Scrubbers 1F1-SCR-01, 1F1-SCR-02, 1F1-SCR-03, and 1F1-SCR-04				
	Emission Factor		**PTE**	
Pollutant	**ppmvd**	**lb/hr***	**tpy**	**Source**
* Emission rates (lb/hr) are calculated using the individual stack emission limit, 8,760 hr/yr of operation, and assumed maximum airflows of 44,000 acfm for 1F1-SCR-01, 02, 03, and 04, each.				

Acid Scrubber 1F1-SCR-15				
	Emission Factor		**PTE**	
Pollutant	**ppmvd**	**lb/hr***	**tpy**	**Source**
NO_x	0.764	0.2739	1.200	SWCAA BACT Limit
ammonia [7664-41-7]	2.15	0.2851	1.249	SWCAA BACT Limit
chlorine (as Cl_2) [7782-50-5]	0.0620	0.03422	0.150	SWCAA BACT Limit
fluorides (as HF) [7664-39-3]	1.09	0.1698	0.744	SWCAA BACT Limit
hydrochloric acid [7647-01-1]	0.370	0.1050	0.459	SWCAA BACT Limit
nitric acid [7697-37-2]	0.162	0.07948	0.348	SWCAA BACT Limit
* Emission rates (lb/hr) are calculated using the individual stack emission limit, 8,760 hr/yr of operation, and assumed maximum airflows of 50,000 acfm for 1F1-SCR-15.				

Acid Scrubbers 1F2-SCR-01 and 1F2-SCR-02 (combined stack)				
	Emission Factor		**PTE**	
Pollutant	**ppmvd**	**lb/hr***	**tpy**	**Source**
NO_x	1.36	0.2731	1.196	SWCAA BACT Limit
ammonia [7664-41-7]	3.84	0.2851	1.249	SWCAA BACT Limit
chlorine (as Cl_2) [7782-50-5]	0.110	0.03400	0.149	SWCAA BACT Limit
fluorides (as HF) [7664-39-3]	0.236	0.02050	0.0902	SWCAA BACT Limit
hydrochloric acid [7647-01-1]	0.660	0.1049	0.460	SWCAA BACT Limit
nitric acid [7697-37-2]	0.0332	0.009121	0.0397	SWCAA BACT Limit
* Emission rates (lb/hr) are calculated using the individual stack emission limit, 8,760 hr/yr of operation, and assumed maximum airflow of 28,000 acfm for 1F2-SCR-01/02.				

Acid Scrubbers 1P5-SCR-01 and 1P5-SCR-02 (combined stack)				
	Emission Factors		**PTE**	
Pollutant	**ppmvd**	**lb/hr***	**tpy**	**Source**
NO_x	1.36	0.2731	1.196	SWCAA BACT Limit
ammonia [7664-41-7]	3.84	0.2851	1.249	SWCAA BACT Limit

Acid Scrubbers 1P5-SCR-01 and 1P5-SCR-02 (combined stack)				
Pollutant	Emission Factors ppmvd	Emission Factors lb/hr*	PTE tpy	Source
chlorine (as Cl_2) [7782-50-5]	0.110	0.03400	0.149	SWCAA BACT Limit
fluorides (as HF) [7664-39-3]	1.49	0.1300	0.574	SWCAA BACT Limit
hydrochloric acid [7647-01-1]	0.660	0.1049	0.460	SWCAA BACT Limit
nitric acid [7697-37-2]	0.216	0.05934	0.260	SWCAA BACT Limit
* Emission rates (lb/hr) are calculated using the individual stack emission limit, 8,760 hr/yr of operation, and assumed maximum airflow of 28,000 acfm for 1P5-SCR-01/02.				

The above emission factors were used for modeling and to establish PTE and are used to determine annual emissions. If recent source test data is available (including in-house testing performed on the ammonia scrubbers), the source test data may be used in lieu of the above factors.

The following table is provided for informational purposes and represents the types and quantities of TAPs emitted by the facility or listed in historical permitting actions. Included is the anticipated control efficiency of the scrubber for the pollutant. Actual emissions will vary from year to year and may exceed the quantities listed below; however, it is not expected that the SQER will be exceeded.

Acid Scrubbers, combined				
Pollutant	Estimated Control Efficiency	Type	SQER lb/yr	PTE lb/yr *
acetic acid [64-19-7]	90%	TAP	10,500	450
arsine [7784-42-1]	50%	HAP/TAP	175	17
boron trifluoride [7637-07-2]	90%	TAP	175	3
hydrogen bromide [10035-10-6]	90%	TAP	5,250	578
hydrogen peroxide [7722-84-1]	90%	TAP	175	28
nitrogen trifluoride [7783-54-2]	—	TAP	10,500	1,622
phosphine [7803-51-2]	0%	TAP	175	29
phosphoric acid [7664-38-2]	80%	TAP	175	62
potassium hydroxide [1310-58-3]	80%	TAP	175	3
silane [7803-62-5]	80%	TAP	1,750	10
sodium bisulfite [7681-38-1]	90%	TAP	175	—
sodium hydroxide [1310-73-2]	80%	TAP	175	110
sulfur hexafluoride [2551-62-4]	0%	TAP	43,748	4,064
sulfuric acid [7664-93-9]	99%	TAP	175	9

Acid Scrubbers, combined				
Pollutant	**Estimated Control Efficiency**	**Type**	**SQER lb/yr**	**PTE lb/yr ***
tetraethylorthosilicate [78-10-4]	99%	TAP	43,748	122
tungsten hexafluoride [7783-82-6]	99%	TAP	175	12
* Pollutants listed with zero emissions represent a situation where the pollutant was emitted in the past but may or may not be emitted in the future.				

Unless specified above, per equipment manufacturer guidance, or determined by performing a source test, all other pollutants are assumed to have no control by the Acid Scrubbers.

6.f. Central Utility Plant (CUP) Scrubber 1C1-SCR-01. This scrubber is rated at 35 acfm. The following emission factor is used for emissions:

Pollutant	Emission Factor		PTE tpy	Source
	ppmv	lb/hr*		
hydrochloric acid [7647-01-1]	10	0.00250	0.0110	SWCAA Limit
* Assumes maximum airflow of 35 acfm.				

The above emission factor was used for modeling and to establish PTE and are used to determine annual emissions. If recent source test data is available, the source test data may be used in lieu of the above factor. Hours of operation may be estimated from the number of shipments using the assumptions that a shipment is 5,000 gal and takes about an hour to offload.

6.g. Cooling Towers. The four towers operate at 14,000 gpm, each, using a combination of city and makeup water; these towers are typically in operation year-round. Tests performed at WaferTech showed TDS concentration of 798 ppm in the cooling water; there are presently 40 concentration cycles. To allow for some variation in the TDS concentration, SWCAA will assume, for PTE purposes, that the TDS concentration is twice that determined during the test. Assuming 1,600 ppm TDS, 0.002% drift rate (from the manufacturer), AP-42 emission calculations for PM, and using guidance for PM_{10} and $PM_{2.5}$ calculations, the following rates were determined for a single cooling tower:

Pollutant	Emission Factor lb/hr*	PTE tpy	Source
PM	0.22	3.854	EPA AP-42 §13.4 (1/1995)†
PM_{10}	0.17	2.978	EPA AP-42 §13.4 (1/1995)†
$PM_{2.5}$	0.00050	0.00876	EPA AP-42 §13.4 (1/1995)†
* Assumes water density of 1.0 g/cm^3 and solid density of 2.5 g/cm^3. † The PM emission rate determined using AP-42 formulas are adjusted for PM_{30}, PM_{10}, and $PM_{2.5}$ based on the technique listed in guidance. The ratio by which the PM emission rate is adjusted depends upon			

> the TDS and the number of cycles. In this case, the adjustments were 93.2%, 26.5%, and 0.16% for PM_{30}, PM_{10}, and $PM_{2.5}$, respectively. [*Calculating Realistic PM_{10} Emissions from Cooling Towers,* Abstract No. 216 Session No. AS-1b, J. Reisman and G. Frisbie, Greyston Environmental Consultants, Inc.]

The above emission factors were used to establish PTE and are used to determine annual emissions. If tests for TDS are performed on the cooling tower water or the number of cycles changes, such information may be used in the calculations to determine annual emissions.

6.h. Emissions Summary. The following assumptions were used to determine facility-wide anticipated maximum emissions:

- Boilers #1 and #2 operated 8,760 hr/yr at the maximum operating rate of 24.4 MMBtu/hr on natural gas (209.55 MMcf/yr);
- Boilers #3 and #4 operated 7,340.2 hr/yr on natural gas (175.55 MMcf/yr) and 1,419.6 hr/yr on fuel oil (251,000 gal/yr) at the maximum operating rate of 24.4 MMBtu/hr
- All Emergency Generator Engines operated 200 hr/yr, each;
- All the Oxidizer/Concentrators operated for 8,760 hr/yr;
- All the scrubbers operated for 8,760 hr/yr, each;
- Oxidizer/Concentrators and Acid Scrubbers emitted at the maximum PTE for permitted toxics or at the maximum usage reported for 2019 to 2022 plus 20% for the mass balance toxics.

Air Pollutant	**Potential to Emit*** **(tpy)**
NO_x	64.66
CO	43.74
VOC	39.30
SO_2	0.33
Lead	Not Applicable
PM	9.81
PM_{10}	8.93
$PM_{2.5}$	5.94
CO_2e, Combustion †	57,816
NH_3	8.75

Air Pollutant	Potential to Emit* (tpy)
H_2S	Not Applicable
Ozone	Not Applicable
TAPs	37.14 ‡
HAPs	5.63 ‡

* PTE is based on SWCAA established permit limits, not the mathematical potentials shown in Section 6 above.

† For purposes of this TSD, only CO_2e from combustion sources were considered. WaferTech's process includes emissions of other greenhouse gases, including hydrofluorocarbons and perfluorocarbons (including SF_6). In any given future year, the totals are expected to vary and may be higher than the values here.

‡ For TAPs and HAPS, Potential to Emit represents a *theoretical* maximum based on SWCAA established permit limits and the maximum chemical usages from 2019–2022 plus 20%. In any given future year individual pollutants or totals are expected to vary and may be higher than the value here.

7. REGULATIONS AND EMISSION STANDARDS

Regulations have been established for the control of emissions of air pollutants to the ambient air. Regulations applicable to the proposed facility that have been used to evaluate the acceptability of the proposed facility and establish emission limits and control requirements include, but are not limited to, the following regulations, codes, or requirements. These items establish maximum emissions limits that could be allowed and are not to be exceeded for new or existing facilities. More stringent limits may be established in the ADP consistent with implementation of Best Available Control Technology (BACT):

7.a. Title 40 Code of Federal Regulations (CFR) 60.7 "Notification and Recordkeeping" requires that notification must be submitted to SWCAA, the delegated authority, for date construction commenced, anticipated initial startup, and initial startup. Boilers #1, #2, #3, and #4 are subject to 40 CFR 60 Subpart Dc and the notification has already been submitted; therefore, the notification requirement under §60.7 no longer applies.

7.b. 40 CFR 60.8 "Performance Tests" requires that emission tests be conducted according to test methods approved in advance by the permitting authority and a copy of the results be submitted to the permitting authority. Boilers #1, #2, #3, and #4 are subject to 40 CFR 60 Subpart Dc and the initial source test has already been performed; therefore, the performance testing requirement under §60.8 no longer applies.

7.c. 40 CFR 60 Subpart Dc "Standards of Performance for Small Industrial-Commercial-Institutional Steam Generating Units" applies to any steam generating unit with a heat input greater than or equal to 10 MMBtu/hr, but less than or equal to 100 MMBtu/hr constructed, modified, or reconstructed after June 9, 1989. Boilers #1, #2, #3, and #4 are rated at 24.4 MMBtu/hr each and were constructed in 1998; therefore, this regulation applies to the boilers. EPA approved an alternative monitoring plan for the four boilers on November 10, 1997 to allow for monthly natural gas monitoring.

For purposes of the Subpart, "biodiesel as defined by the American Society of Testing and Materials in ASTM D6751, or biodiesel blends as defined by the American Society of Testing and Materials in ASTM D7467" is included under the definition of "distillate oil" per §60.41c.

7.d. 40 CFR 63.7 "Performance testing requirements" requires performance testing per relevant sections of 40 CFR 63.

Emergency Generator Engines #1 through #6 are subject to 40 CFR 63 Subpart ZZZZ but are not subject to any numerical emission standards in Tables 1b, 2b, or 2d; therefore §63.7 does not apply to the emergency generator engines.

Boilers #1 and #2 are not subject to 40 CFR 63 Subpart JJJJJJ; they only burn natural gas. However, Boilers #3 and #4 are subject to 40 CFR 63 Subpart JJJJJJ, because they burn #2 fuel oil or biodiesel (liquid fuels in the oil subcategory) during periods of contractual natural gas curtailment. Based on boiler size, Boilers #3 and #4 are not subject to any numerical emission standards in Table 1 of Subpart JJJJJJ and no source testing is required; therefore, §63.7 does not apply to the boilers. Biennial tuning is required but is not considered to be source testing.

7.e. 40 CFR 63.9 "Notification Requirements" requires that notification must be submitted to the Administrator for initial startup. The existing emergency generator engines are subject to 40 CFR 63 Subpart ZZZZ but are not subject to the notification requirements of §§63.7(b) and (c), 63.8(e), (f)(4), and (f)(6), 63.9(b)–(e), (g), and (h) per §63.6645(a)(5); therefore §63.9 does not apply to the emergency generator engines.

Boilers #1 and #2 are not subject to 40 CFR 63 Subpart JJJJJJ as they can only burn natural gas. However, Boilers #3 and #4 are subject to 40 CFR 63 Subpart JJJJJJ, because they burn #2 fuel oil or biodiesel (liquid fuels in the oil subcategory) during periods of contractual natural gas curtailment. An initial notification is required per §§63.11225(a)(1), (2), and (4) and an annual notification is required to be prepared per §63.11225(b); therefore §63.9 applies to Boilers #3 and #4.

7.f. 40 CFR 63 Subpart ZZZZ [§63.6580 *et seq*] "National Emissions Standards for Hazardous Air Pollutants (NESHAP) for Stationary Reciprocating Internal Combustion Engines" establishes national emission limitations and operating limitations for HAP emitted from stationary reciprocating internal combustion engines located at major and area sources of HAP emissions. The facility is an area source of HAP and Emergency Generator Engines #1 through #6 are existing compression ignition internal combustion engine configurations used in emergency situations constructed prior to 2006; therefore, this regulation applies to the engines. For existing emergency engines at an area source, the owner or operator is required to:

- Change oil and filter every 1,000 hours of operation or annually, whichever comes first except as allowed by 40 CFR 63.6625(i);

- Inspect air cleaner every 1,000 hours of operation or annually, whichever comes first;
- Inspect all hoses and belts every 500 hours of operation or annually, whichever comes first, and replace as necessary;
- Operate and maintain the stationary reciprocating internal combustion engine and after-treatment control device (if any) according to the manufacturer's emission-related written instructions or develop a maintenance plan which must provide to the extent practicable for the maintenance and operation of the engine in a manner consistent with good air pollution control practice for minimizing emissions;
- Install a non-resettable hour meter if one is not already installed. [40 CFR 63.6625(f)]
- Minimize the engine's time spent at idle during startup and minimize the engine's startup time to a period needed for appropriate and safe loading of the engine, not to exceed 30 minutes;
- Report each instance in which the owner did not meet each operating limitation;
- Limit operation of the engine to emergency use and maintenance checks and readiness testing. Operation for maintenance checks and readiness testing may be conducted only to the extent that the tests are recommended by Federal, State, or local government, the manufacturer, the vendor, or the insurance company associated with the engine. Operation for maintenance checks and readiness testing is limited to 100 hr/year;
- Record the occurrence and duration of each malfunction of operation (i.e., process equipment);
- Record maintenance conducted on the engine to demonstrate that the engine was operated and maintained according to the applicable maintenance plan; and
- Record the hours of operation of the engine by use of a non-resettable hour meter. The owner or operator must document how many hours are spent for emergency operation, including what classified the operation as emergency and how many hours are spent for non-emergency operation.

There may be other requirements under the Subpart that apply to the facility that are not specified above. SWCAA has not yet taken delegation of this regulation; therefore, at this time, EPA is the Administrator of this regulation, and the facility must communicate directly with EPA regarding compliance demonstrations and/or reporting required by this rule.

For purposes of this Subpart, "diesel fuel" also includes any non-distillate fuel with comparable physical and chemical properties (e.g., biodiesel) that is suitable for use in compression ignition engines per §63.6675.

7.g. <u>40 CFR 63 Subpart BBBBB [§63.7180 et seq] "National Emission Standards for Hazardous Air Pollutants for Semiconductor Manufacturing"</u> applies to semiconductor manufacturing facilities that are major sources of HAP and establishes emission standards and requirements to demonstrate initial and continuous compliance with the emission standards. WaferTech is not a major source of HAP; therefore, this regulation does not apply.

7.h. <u>40 CFR 63 Subpart JJJJJJ [§63.11193 et seq] "National Emission Standards for Hazardous Air Pollutants for Industrial, Commercial, and Institutional Boilers Area Sources"</u> establishes national emission limitations and operating limitations for HAP emitted from boilers fired on specific fuels at area sources. The facility is an area source of HAP. Boilers #1 and

#2 are not subject to 40 CFR 63 Subpart JJJJJJ as they can only burn natural gas. However, Boilers #3 and #4 are subject to 40 CFR 63 Subpart JJJJJJ, because #2 fuel oil or biodiesel (liquid fuels in the oil subcategory) are burned during periods of contractual natural gas curtailment; therefore, this regulation applies to Boilers #3 and #4.

For existing oil-fired boilers at an area source, the owner or operator is required to comply with the following:

- Submit an initial notification to the Administrator by January 20, 2014.
- Demonstrate compliance with the work practice standards and the energy assessment no later than March 21, 2014, as specified in §63.11196(1) and (3);
- Conduct a one-time energy assessment (for facilities with boilers >10 MMBtu/hr) as required in §63.11214(c);
- Conduct a tune-up once every two years as specified in §63.11223(b). A tune-up report must be maintained on-site and submitted to the Administrator upon request.
- Submit notifications as required in §§63.11225(a)(1), (a)(2), and (a)(4), and (b);
- Submit a compliance report once every two years by March 1st to the delegated enforcement authority with the information specified in §63.11225(a)(1), (2), and (4); and
- Maintain records as required in §§63.11225(c) and (d).

There may be other requirements under the Subpart that apply to the facility that are not specified above. SWCAA has not yet taken delegation of this regulation; therefore, at this time, EPA is the Administrator of this regulation, and the facility must communicate directly with EPA regarding compliance demonstrations and/or reporting required by this rule.

For purposes of this Subpart, "distillate oil" includes "biodiesel as defined by the American Society of Testing and Materials in ASTM D6751-11b" per §63.11237. Also, "liquid fuels" includes "distillate oil, residual oil, any form of liquid fuel derived from petroleum, used oil meeting the specification in 40 CFR 279.11, liquid biofuels, biodiesel, and vegetable oil, and comparable fuels as defined under 40 CFR 261.38."

7.i. 40 CFR 68 "Chemical Accident Prevention Provisions" requires affected stationary sources to compile and submit a risk management plan, as provided in §§68.150–68.185. Applicability is determined by the type and quantity of material stored at the facility. Based on a letter dated April 5, 1999, from WaferTech, the facility will not utilize any substance that meets the listed thresholds; therefore, this regulation does not apply to this facility. This determination may change if the facility handles a substance that meets the listed thresholds, however changes in applicability for 40 CFR 68 typically do not trigger minor permitting. This regulation is not directly enforced by SWCAA.

7.j. 40 CFR 70 "State Operating Permit Programs" requires facilities with site emissions of any regulated air pollutant greater than 100 tpy, any single HAP greater than 10 tpy, or any aggregate combination of HAPs greater than 25 tpy, or any PSD facility with site emissions of CO_2e above 10,000 tpy. WaferTech does not meet any of these applicability criteria; therefore, this regulation does not apply to the facility.

7.k. Revised Code of Washington (RCW) 70A.15.2040 empowers any activated air pollution control authority to prepare and develop a comprehensive plan or plans for the prevention, abatement, and control of air pollution within its jurisdiction. An air pollution control authority may issue such orders as may be necessary to effectuate the purposes of the Washington Clean Air Act (RCW 70.94) and enforce the same by all appropriate administrative and judicial proceedings subject to the rights of appeal as provided in Chapter 62, Laws of 1970 ex. sess. This law applies to the facility.

7.l. RCW 70A.15.2210 provides for the inclusion of conditions of operation as are necessary to assure the maintenance of compliance with the applicable ordinances, resolutions, rules, and regulations when issuing an ADP for installation and establishment of an air contaminant source. This law applies to the facility.

7.m. Washington Administrative Code (WAC) 173-401 "Operating Permit Regulation" requires all major sources and other sources as defined in WAC 173-401-300 to obtain an operating permit. This regulation is not applicable because this source is not a potential major source and does not meet the applicability criteria set forth in WAC 173-401-300.

7.n. WAC 173-401-300(7) "Federally Enforceable Limits" provides that any source with the potential to emit exceeding the tonnage thresholds defined in WAC 173-401-200(18) can be exempted from the requirement to obtain an Operating Permit when federally enforceable conditions are established which limit that source's potential to emit to levels below the relevant tonnage thresholds. The facility does not have a PTE above 100 tpy for any criteria pollutant and although the ADP does include a limit on the total quantity of HAP that can be emitted at the facility, the facility does not have a PTE above 10 tpy for any individual HAP or 25 tpy for any combination of HAP. The facility is a natural minor with respect to criteria pollutants and HAPs; therefore, this regulation does not apply.

7.a. WAC 173-441 "Reporting of Emissions of Greenhouse Gases" establishes mandatory greenhouse gas (GHG) reporting requirements for owners and operators of certain facilities that directly emit GHG as well as for certain suppliers and electric power entities. WaferTech is expected to emit more than 10,000 t CO_2e/year (11,000 t CO_2e/yr); therefore, WaferTech is subject to this regulation. Note that WA Department of Ecology, not SWCAA, is the implementing agency for this regulation.

7.p. WAC 173-460 "Controls for New Sources of Toxic Air Pollutants" requires BACT for toxic air pollutants (T-BACT), identification and quantification of emissions of TAPs and demonstration of protection of human health and safety. The facility emits TAPs; therefore, this regulation applies to the facility.

7.q. WAC 173-476 "Ambient Air Quality Standards" establishes ambient air quality standards for PM_{10}, $PM_{2.5}$, lead, SO_2, NO_x, ozone, and CO in the ambient air, which must not be exceeded. The facility emits PM_{10}, $PM_{2.5}$, SO_x, NO_x, and CO; therefore, certain sections of this regulation apply. The facility does not emit lead; therefore, the lead regulation section does not apply.

7.r. WAC 173-481 "Ambient Air Quality and Environmental Standards for Fluorides" establishes fluoride standards for the protection of livestock and vegetation. If fluoride impacts or damage occur, monitoring and corrective actions may be required, by request, by the WA State Department of Ecology (WDOE) to demonstrate compliance with the ambient action levels. To date, no request by WDOE has been made. Note that this regulation is not triggered by new source review. Based on modeling data provided by WaferTech, the modeled impact on the nearest public land use area (Grass Valley Park, to the southeast), approximately 1,325 m from the facility and the nearest agricultural area (to the north-northeast near Warman Lake), approximately 2,000 m from the facility are listed below:

	1F1-SCR-01	1F1-SCR-02	1F1-SCR-03	1F1-SCR-04	1F1-SCR-15	1F2-SCR-01/02	1P5-SCR-01/02
1-hr Modeled Conc (μg/m³)/(lb/hr)	3.161	3.161	3.161	3.161	3.161	4.129	4.129
Maximum Emission Rate (lb/hr)	0.171	0.171	0.171	0.171	0.171	0.021	0.13
1-hr Modeled Conc (μg/m³)	0.54	0.54	0.54	0.54	0.54	0.087	0.54
24-hr Modeled Conc (μg/m³)	0.26	0.22	0.22	0.28	0.27	0.03	0.21

Total 24-hr Modeled Conc **1.50** **μg/m³ at 1,325 m (Public Land Use Area)**

	1F1-SCR-01	1F1-SCR-02	1F1-SCR-03	1F1-SCR-04	1F1-SCR-15	1F2-SCR-01/02	1P5-SCR-01/02
1-hr Modeled Conc (μg/m³)/(lb/hr)	1.841	1.841	1.841	1.841	1.841	1.952	1.952
Maximum Emission Rate (lb/hr)	0.171	0.171	0.171	0.171	0.171	0.021	0.13
1-hr Modeled Conc (μg/m³)	0.31	0.31	0.31	0.31	0.31	0.04	0.25
24-hr Modeled Conc (μg/m³)	0.17	0.16	0.17	0.17	0.17	0.02	0.15

Total 24-hr Modeled Conc **1.00** **μg/m³ at 2,000 m (Agricultural Area)**

Scrubber 1F2-SCR-01/02 are assumed to be the same as scrubber 1P5-SCR-01/02 and scrubbers 1F1-SCR-01, 1F1-SCR-02, 1F1-SCR-03, 1F1-SCR-04, and 1F1-SCR-15 are assumed to be the same for modeling purposes. Based on the modeled results, no adverse impact to these areas is anticipated. However, this regulation may become future applicable.

7.s. SWCAA 400-040 "General Standards for Maximum Emissions" requires all new and existing sources and emission units to meet certain performance standards with respect to Reasonably Available Control Technology (RACT), visible emissions, fallout, fugitive emissions, odors, emissions detrimental to persons or property, SO_2, concealment and masking, and fugitive dust. This regulation applies to the facility.

7.t. SWCAA 400-040(1) "Visible Emissions" requires that emissions of air contaminants from any emissions unit must not exceed twenty percent opacity for more than three (3) minutes in any 1-hr period at the emission point, or within a reasonable distance of the emission point. This regulation applies to the facility.

7.u. SWCAA 400-040(2) "Fallout" requires that PM emissions from any source must not be deposited beyond the property under direct control of the owner(s) or operator(s) of the source in sufficient quantity to interfere unreasonably with the use and enjoyment of the property upon which the material is deposited. This regulation applies to the facility.

7.v. SWCAA 400-040(3) "Fugitive Emissions" requires that reasonable precautions must be taken to prevent the fugitive release of air contaminants to the atmosphere. This regulation applies to the facility.

7.w. SWCAA 400-040(4) "Odors" requires any source which generates odors that may unreasonably interfere with any other property owner's use and enjoyment of their property to use recognized good practice and procedures to reduce these odors to a reasonable minimum. This source must be managed properly to maintain compliance with this regulation. This regulation applies to the facility.

7.x. SWCAA 400-040(6) "Sulfur Dioxide" requires that gases containing more than 1,000 ppmvd of SO_2, corrected to 7% oxygen (O_2) or 12% CO_2 as required by the applicable emission standard for combustion sources must not be emitted by any person. The facility emits SO_2; therefore, this regulation applies to the facility.

7.y. SWCAA 400-040(8) "Fugitive Dust Sources" requires that reasonable precautions must be taken to prevent fugitive dust from becoming airborne and minimize emissions. This regulation applies to the facility.

7.z. SWCAA 400-050 "Emission Standards for Combustion and Incineration Units" requires that all provisions of SWCAA 400-040 must be met, and that no person must cause or permit the emission of PM from any combustion or incineration unit more than 0.23 g/dscm (0.1 gr/dscf) of exhaust gas at standard conditions. The facility has combustion units; therefore, this regulation applies to the facility.

7.aa. SWCAA 400-060 "Emission Standards for General Process Units" requires that all new and existing general process units must not emit PM more than 0.23 g/dscm (0.1 gr/dscf) of exhaust gas. The facility has general process units; therefore, this regulation applies to the facility.

7.bb. SWCAA 400-091 "Voluntary Limits on Emissions" allows sources to request voluntary limits on emissions and potential to emit by submittal of an ADP application as provided in SWCAA 400-109. Upon completing review of the application, SWCAA may issue a Regulatory Order that restricts the source's potential to emit. The facility does not have a PTE above 100 tpy for any criteria pollutant and although the ADP does include a limit on the total quantity of HAP that can be emitted at the facility, the facility does not have a PTE above 10 tpy for any individual HAP or 25 tpy for any combination of HAP. The facility is a natural minor with respect to criteria pollutants and HAPs; therefore, this regulation does not apply.

7.cc. SWCAA 400-110 "New Source Review" requires that an ADP Application be filed with SWCAA, and an ADP be issued by SWCAA, prior to establishment of the new source, emission unit, or modification. The new units meet the definition of a new source; therefore, this regulation applies to the facility.

7.dd. SWCAA 400-111 "Requirements for Sources in a Maintenance Plan Area" requires that no approval to construct or alter an air contaminant source will be granted unless it is evidenced that:

(1) The equipment or technology is designed and will be installed to operate without causing a violation of the applicable emission standards;
(2) Emissions will be minimized to the extent that the new source will not exceed emission levels or other requirements provided in the maintenance plan;
(3) BACT will be employed for all air contaminants to be emitted by the proposed equipment;
(4) The proposed equipment will not cause any ambient air quality standard to be exceeded; and
(5) If the proposed equipment or facility will emit any TAP regulated under WAC 173-460, the proposed equipment and control measures will meet all the requirements of that Chapter.

The facility is in a maintenance plan area; therefore, this regulation applies to the facility.

8. BACT/PSD/CAM DETERMINATIONS

The proposed equipment and control systems incorporate BACT for the types and amounts of air contaminants emitted by the processes as described below:

8.a. BACT Determination – Boilers #1, #2, #3, and #4. The use of natural gas as the primary fuel and low NO_x burners to achieve NO_x emissions of 30 ppmv and CO emissions of 50 ppmv was determined to meet the requirements of BACT for the boilers at the time of initial approval. While firing on liquid fuels, the use of burners capable of achieving NO_x emissions of 140 ppmv, CO emissions of 90 ppmv, and a liquid fuel consumption limit was determined to meet the requirements of BACT for the boilers while combusting fuel oil at the time of initial approval.

In previous permitting actions, the potential use of active combustion control on the boilers was evaluated. It was determined that this type of combustion control is not designed for internal burners installed in WaferTech's boilers.

8.b. BACT Determination – Diesel Engine Generators. The use of modern diesel-fired internal combustion engine design, ultralow sulfur #2 fuel oil or biodiesel (<15 ppmw sulfur), limitation of visible emissions to 5% opacity or less, and limitation of engine/generator operation to testing and actual power interruptions was determined to meet the requirements of BACT for the types and quantities of air contaminants emitted from the diesel-engine powered emergency generators at the time of initial approval. SWCAA assumes that the boiler emissions characteristics while burning biodiesel are comparable with #2 fuel oil.

8.c. BACT Determination – Oxidizer/Concentrators. The use of an oxidizer/concentrator system capable of achieving a VOC destruction efficiency of at least 95% by design, an exhaust gas opacity of 0% and vertical discharge of air contaminants at an adequate stack height and exit velocity for suitable atmospheric dispersion was determined to meet BACT and T-BACT for the types and quantities of air contaminants emitted from this source at the time of initial approval.

In this current permitting action, annual limits for total VOC and IPA were increased due to steady increases in production rates due to more efficient processing techniques. The original BACT assessment has not changed because of these increases.

8.d. BACT Determination – Acid and Ammonia Scrubbers. The use of pH-controlled scrubbers was determined to meet BACT and T-BACT for the types and quantities of air contaminants emitted from this source at the time of initial approval. It is expected that there is also some control of NO_X that is achieved with the use of scrubbers, which, at the levels being emitted, meets the definition of BACT for NO_X.

In the current permitting action, annual emission limits for HF and HNO_3 were increased because of steady increases in production rates due to more efficient processing techniques. The initial BACT assessment for this increase has not changed because of these increases.

8.e. BACT Determination – Central Utility Plant Scrubber. The use of pH-controlled scrubbers has been determined to meet BACT and T-BACT for the types and quantities of air contaminants emitted from this source at the time of initial approval.

8.f. BACT Determination – Cooling Towers. The four large cooling towers have been considered insignificant in previous permitting actions using a recirculation rate of 200,000 gal/day; the towers operate at 20,160,000 gal/day (14,000 gpm). When the appropriate emission factors are applied (see Section 6.f), the emissions on an individual or collective basis cannot be considered insignificant. These identically sized units are equipped with mist eliminators that achieve a 0.002% drift rate. While there has not been an official BACT determination performed and there have been no changes to these units since the construction of the facility, the use of mist eliminators for cooling towers has been determined to meet BACT for the types and quantities of air contaminants emitted from this source.

8.g. Prevention of Significant Deterioration (PSD) Applicability Determination. This permitting action will not result in a potential increase in emissions equal to or greater than the PSD thresholds. Therefore, PSD review is not applicable to this action.

8.h. Compliance Assurance Monitoring (CAM) Applicability Determination. CAM is not applicable to any emission unit at this facility because it is not a major source and is not required to obtain a Part 70 (Title V) permit.

9. AMBIENT IMPACT ANALYSIS

9.a. Criteria Air Pollutant Review. Emissions of NO_x, CO, PM, VOC (as a precursor to ozone), and SO_2 are emitted at levels where no adverse ambient air quality impact is anticipated. There are no modifications proposed in ADP Application CL-3147 that will increase the quantities of any criteria air pollutant.

9.b. TAP Review. WaferTech has proposed in ADP Application CL-3147 to increase the emission limit of HF, and HNO_3, for six of the seven Acid Scrubbers. WaferTech has also proposed an increase in the emission limit of Isopropanol for four of the six oxidizers/concentrators; All three pollutants are TAPs. In previous permitting action, there was reference to maximum anticipated emissions on a facility-wide basis. The "limits" were assumed to 1) be equivalent to the stated maximum anticipated emissions and 2) to be below the SQER for each pollutant.

For those TAPs which are anticipated to be emitted above the SQER listed in WAC 173-460 (8/21/1998), the following are discussions of the anticipated impacts.

Ammonia. During previous permitting actions, an Ammonia limit was established for Acid Scrubbers and Ammonia scrubbers. Emissions are expected to be less than the SQER of 17,500 lb/yr; therefore, no adverse impact to the ambient air quality is expected.

Chlorine. Under ADP 14-3111, the emission limit for chlorine was increased to 1.0 tpy. The increase under that permitting action was greater than the SQER for Cl_2 of 175 lb/yr. EPA AERSCREEN (version 11126) was run using terrain files, a simplified Building Profile Input Program (BPIP) model of the facility, and rural/wet conditions. It was assumed that the entire increase of 1,600 lb/yr was emitted through a single discharge point, the combined stack for Acid Scrubbers 1P5-SCR-01 and 1P5-SCR-02. Actual flow for this stack was 18,000 dscfm, as determined during the October 26, 2010, source test; the design flow rate for the stack is 28,000 acfm. The 18,000 dscfm flow rate represents the lowest flow rate of any acid scrubber exhaust at the facility. Using this flow and assuming all the Cl_2 increase (0.183 lb/hr) was emitted through this stack, the model predicted 4.987 µg/m³ as a 24-hr average, which is below the ASIL of 5 µg/m³ for Cl_2. By demonstrating that the ASIL is not exceeded using these conservative assumptions, it is asserted that under actual operating conditions, where the Cl_2 emissions would be more equally distributed, that no adverse impact to ambient air quality is anticipated. By assuming that 300 lb/yr (0.0342 lb/hr) was emitted from the same stack, the model predicted 0.769 µg/m³ as a 24-hr average.

Fluorine and Hydrogen Fluoride. In the original permitting action, SWCAA included limits for both F_2 and hydrogen fluoride (HF) based on WaferTech's ADP application as both chemicals are produced or used in the IC manufacturing process. Emissions of both F_2 and HF are primarily controlled by scrubbers. SWCAA applied an assumed scrubber efficiency to the expected uncontrolled emissions of F_2 and HF to determine a controlled emission limit for permitting purposes. These limits were carried forward for several subsequent permitting actions.

During the permitting action for ADP 14-3111, inherent problems in the original assumptions made in early permitting actions were discovered. One issue is whether F_2 gas is emitted by the facility. Based on discussions with the facility, F_2 gas is produced directly by processes that use nitrogen trifluoride (NF_3) in a plasma. The plasma strips fluorine atoms off the NF_3 molecule where they recombine to form F_2 gas. The exhaust from these processes is controlled via the Ammonia and Acid Scrubbers. However, F_2 gas, being the most reactive halogen gas, is so chemically reactive that it does not occur in nature, except in very rare cases in radioactive materials[3,4]. The F_2 bond is relatively weak and causes the gas to combine with other substances easily, including water, as is readily available in the scrubbers. Due to the inherent reactivity of F_2 gas, it is extremely unlikely that it is emitted to ambient air and is instead fully reacted to a soluble (such as HF) or insoluble (such as calcium fluoride) fluoride compound.

The other issue is whether F_2 gas can be detected though a source test. SWCAA records of multiple source tests by several different testing companies performed on the Acid Scrubbers using EPA Method 26/26A state positive results for F_2 gas being detected in the exhaust gas. It was assumed that EPA Method 26/26A was able to separate F_2 gas from HF in an exhaust stream; however, the Method does not include F_2 gas as an analyte. The assumption was that F_2 gas and its halide acid, HF, behave similarly to Cl_2/HCl and bromine (Br_2)/HBr. In the Method, HF, HCl, and HBr are captured in an impinger with dilute (0.1 N) sulfuric acid and the halide gas (Cl_2, Br_2) is captured and split in an impinger with dilute (0.1 N) NaOH. However, it appears that under ambient conditions, that the chemical mechanism to capture and split the halide gas in the second impinger does not hold true for F_2; for the F_2 reaction to occur as expected in the Method, the temperature would need to be 32 °F in the presence of low-pressure F_2 gas[5]; neither condition exists at the facility. In the case that any F_2 would pass through the scrubbers unreacted, it is more likely that the F_2 would react in the first impinger through direct contact with the dilute acid to form HF as this reaction is favored. Due to the reactivity of F_2, it does not appear that the reaction is influenced by dilute acids or bases and instead reacts with the water. Any fluoride detected in the second impinger would potentially be due to inadequate capture or HF "blow by" through the first impinger. Any fluoride ion detected in either impinger must be due to detected HF, not F_2. This conclusion is supported by the fact that there is no EPA Method that specifically measures F_2 separate from HF; all the methods reviewed pass the exhaust stream through a liquid solution (typically water) to react F_2 to HF, which would be indistinguishable from any entrained HF.

Because of these two issues, ADP 14-3111 eliminated the F_2 limit (since F_2 is only emitted as HF), retained the HF limit (reclassifying it as "fluorides as HF"), and modified the procedure when using EPA Method 26A to include a third impinger between the acid and alkaline impingers and required that the test results be reported as "fluorides as HF." These changes provide a more consistent defendable emission limit that can be verified through a more complete test method.

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[3] United States. U.S. Department of Health and Human Services, Public Health Service. Agency for Toxic Substances and Disease Registry (ATSDR). *Toxicological Profile for Fluorides, Hydrogen Fluoride, and Fluorine*. By Carolyn A. Tylenda, Dennis Jones, and Lisa Ingerman. *Toxic Substances Portal - Fluorides, Hydrogen Fluoride, and Fluorine*. ATSDR, 3 Mar. 2011. p. 2. Web. 11 Nov. 2013. <http://www.atsdr.cdc.gov/toxprofiles/tp.asp?id=212&tid=38>.

[4] Kirk, Raymond Eller, and Donald Frederick Othmer. *Kirk-Othmer Concise Encyclopedia of Chemical Technology*. 4th ed. New York (etc.): Wiley, 1999. Print. p. 883. Print.

[5] Wiberg, Egon, Nils Wiberg, and A. F. Holleman. *Inorganic Chemistry*. San Diego: Academic, 2001. p. 441. Print.

Hydrofluoric Acid. In the current permitting action, WaferTech is proposing changes to the HF limits for the Acid Scrubbers. These changes exceed the SQER for HF and as such, modeling was required to show compliance with the ASIL. WaferTech hired AECOM to run the EPA AERSCREEN model (v. 16216), which incorporated USEPA's Building Input Program (v. 04274), and AERMAP (v. 11103). This model was used to model the impact of HF emissions from each of the Acid Scrubbers, except for Acid Scrubber 1F2-SCR-01/02. Since the emissions from Acid Scrubber 1F2-SCR-01/02 were proposed to decrease, SWCAA did not want to model "negative emissions," so the contribution to the modelled impact from the scrubber was set to zero. Based on the results of the model, a total impact of 7.30 µg/m³ as a 24-hour average was determined. This is less than the 1998 ASIL listed of 8.7 µg/m³ and less than the 2019 ASIL of 14 µg/m³; therefore, no adverse impact to the ambient air quality is expected.

Formaldehyde. In the original 1997 permitting action (ADP 97-2040), formaldehyde emissions from the six oxidizers were included for review and it was determined that the emissions were below the SQER; emissions were estimated at 2 lb/yr with the SQER at 20 lb/yr. At that time, EPA had not published natural gas combustion factors for formaldehyde, so no calculations were performed for the boilers. Since the original permitting action, new emission factors have been developed for boilers; however, there has been no increase in emissions as formaldehyde was assumed to have always been emitted. In several recent actions, EPA has determined that CO can be often used as an appropriate surrogate for formaldehyde. Since the boilers undergo regular, periodic testing for CO emissions, SWCAA has determined that the CO limit is protective of the ambient air quality with respect to formaldehyde and that no additional permit limits are necessary.

Isopropanol. In the current permitting action, WaferTech is requesting an increase in the emission limits for isopropanol for the oxidizer/concentrators based on an increase of usage due to an increase in production. The previous permitted emission rate for oxidizer /concentrators 1F1-VOC-01 and 1F1-VOC-03 was 7,000 lb/yr and the permitted emission rate for oxidizer/concentrators 1F1-VOC-02, 1F1-VOC-04, 1F1-VOC-05, and 1F1-VOC-06 was 5,000 lb/yr. WaferTech has proposed to equalize the emission limit for each of the oxidizers/concentrators. The emission limit for Oxidizer/Concentrators 1F1-VOC-01, 1F1-VOC-04, 1F2-VOC-05 and 1F2-VOC-06 will be increased to 7,000 lb/yr. The total increase in emissions proposed is 8,000 lb/yr for this permitting action. This increase is below the SQER of 43,478 lb/yr for isopropanol; therefore, no adverse impact to ambient air quality is anticipated.

Nitric Acid. In the current permitting action, WaferTech is proposing changes to the HNO_3 limits for the Acid Scrubbers. The proposed increase of HNO_3 emissions was increased to 0.259 lb/hr, which is greater than the SQER of 0.16 lb/hr. WaferTech hired AECOM to run the EPA AERSCREEN model (v. 162216), which incorporated the Building Profile Input Program (v. 04274) and AERMAP (v.11103). This program was used to model the impact of HNO_3 emissions from each of the Acid Scrubbers, except for Acid Scrubber 1F2-SCR-01/02. Since the emissions from Acid Scrubber 1F2-SCR-01/02 were proposed to decrease, SWCAA did not want to model "negative emissions," so the contribution to the modelled impact from the scrubber was set to zero. Based on the results of the model, a total impact of 3.32 µg/m³ as a 24-hour average and 8.3 µg/m³ as a 1-hr average was determined. This is less than the 1998 ASIL listed of 86 µg/m³ as a 24-hour average and less than the 2019 ASIL of 86 µg/m³ as a 1-hr average; therefore, no adverse impact to the ambient air quality is expected.

Conclusions

9.c. The modifications, as proposed in ADP Application CL-3147, will not cause the ambient air quality requirements of 40 CFR 50 "National Primary and Secondary Ambient Air Quality Standards" to be violated.

9.d. The modifications, as proposed in ADP Application CL-3147, will not cause the requirements of WAC 173-460 "Controls for New Sources of Toxic Air Pollutants," WAC 173-470 "Ambient Air Quality Standards for Particulate Matter," WAC 173-474 "Ambient Air Quality Standards for Sulfur Oxides," and WAC 173-475 "Ambient Air Quality Standards for Carbon Monoxide, Ozone, and Nitrogen Dioxide" to be violated.

9.e. Any affected unit, proposed in ADP Application CL-3147, can be operated without causing a violation of emission standards for sources as established under SWCAA General Regulations Sections 400-040 "General Standards for Maximum Emissions," 400-050 "Emission Standards for Combustion and Incineration Units," and 400-060 "Emission Standards for General Process Units."

10. DISCUSSION OF APPROVAL CONDITIONS

SWCAA has decided to issue ADP 23-3586 in response to ADP Application CL-3147. ADP 23-3586 contains approval requirements deemed necessary to assure compliance with applicable regulations and emission standards as discussed below.

10.a. Supersession of Previous Permits. ADP 23-3586 supersedes ADP 19-3351 in its entirety.

10.b. Emission Limits. Emission limits for approved equipment are based on the maximum potential emissions calculated in Section 6 of this Technical Support Document.

Boilers. NO_x, CO, PM, and VOC emission limits for natural gas and liquid fuels (#2 fuel oil and biodiesel) remained the same from the last permitting action. SWCAA uses a sulfur content of 15 ppmw for liquid fuels (including biodiesel). Visible emission limits were unchanged from the past permitting action.

Emergency Generators. NO_x, CO, and PM emission limits for natural gas and liquid fuels (#2 fuel oil and biodiesel) remained the same from the last permitting action. PTE calculations assume 200 hr/yr of operation. Visible emission limits were unchanged from the past permitting action.

Oxidizer/Concentrators. Long and short-term emission limits for NO_x, CO, PM_{10}, $PM_{2.5}$, ethanolamine, and IPA, as appropriate, remained the same as the previous permitting action. Visible emission limits were unchanged from the past permitting action.

Because four oxidizer/concentrator units (1F1-VOC-01 through 04) have combined stacks and two have separate stacks (1F2-VOC-05 and 06) and to clarify the location of compliance for each unit, separate emission limits for each were included.

Acid and Ammonia Scrubbers. Long and short-term emission limits for NH_3, Cl_2, and HCl emission limits, as appropriate, remained the same from the previous permitting action. There are seven stacks for all the acid scrubbers, except only six of the seven have ammonia scrubbers that feed into the acid scrubbers. The HF and HNO_3 long and short-term emission limits were increased (or decreased for scrubber 1F2-SCR-01/02) as proposed, due to an increase and changes in production.

Central Utility Plant Scrubber. Long and short-term emission limits for HCl remained the same as established in the previous permitting action.

Cooling Towers. Long term emission limits for PM, PM_{10}, and $PM_{2.5}$ remained the same as established in the previous permitting action.

10.c. Operational Limits and Requirements. Standard operating requirements were included regarding good operation of the facility, minimization of odors, operation of air pollution control equipment and the prohibition of stack caps.

Boilers. Boilers #1 and #2 are limited to burning natural gas and Boilers #3 and #4 are limited to burning natural gas, #2 fuel oil (<15 ppmw sulfur), or biodiesel (<15 ppmw sulfur). An operational limit for liquid fuels was included from the previous permitting action.

Emergency Generators. The emergency generator engines are limited to burning liquid fuels (#2 fuel oil or biodiesel) containing 15 ppmw sulfur or less and are limited to 300 hr/yr operation. Maintenance and testing are limited to 100 hr/yr per SWCAA 400-072.

Oxidizer/Concentrators. General operating requirements for good combustion and to maintain adequate destruction efficiency were included from the previous permitting action.

Acid and Ammonia Scrubbers. During normal operation, it is expected that there can be short-term "spikes" in either the pH or in the flow for these units and an averaging period that is expected to ensure compliance is included. Excursions in the past have not had any significant impact on emissions. Scrubber liquor recirculation flow rates are measured across both the packing and the front spray bars; Scrubber 1F1-SCR-15 flow rate is measured across the packing only. General operating requirements to maintain adequate control efficiency were included from the previous permitting action.

Central Utility Plant Scrubber. Like the acid scrubbers, during normal operation, the CUP Scrubber may have short-term "spikes" in either the pH or the flow. The ADP includes an averaging period that is expected to ensure compliance while addressing these small excursions, should they occur.

10.d. Monitoring and Recordkeeping Requirements. The ADP establishes monitoring and recordkeeping requirements sufficient to document compliance with applicable emission limits, ensure proper operation of approved equipment and provide for compliance with applicable requirements.

A procedure for a qualitative assessment of visible emissions was provided. The expectation is that other than the boilers when they are burning #2 fuel oil, there are very few sources that would have visible emissions during normal operation. A monthly observation to determine the presence or absence of viable emissions with a procedure for corrective action when visible emissions are observed is expected to provide assurance that the visible emissions limits are being met. It does not preclude the use of EPA or SWCAA Method 9 to determine compliance, which is always an option.

Requirements for monitoring and recording fuel usage, operational parameters, records of maintenance activities, and the results of periodic inspections conducted by facility personnel were also included.

10.e. Emission Monitoring and Testing Requirements.

Boilers. Because the facility can be curtailed from using natural gas for several days to weeks, a requirement to tune the boilers on liquid fuels when burning fuel oil for more than 72 hours is included. The purpose is to demonstrate compliance with the liquid fuel limits and to ensure proper operation of the boiler. Because curtailments are most frequent during the winter, by tuning no later than March 31, it is expected that WaferTech would only need to tune on natural gas and liquid fuel only once in any given calendar year; an emission monitoring (tuning) protocol in Appendix B. Because the burners are separate from one another, any tune-up activities performed on the natural gas burners do not affect the operation of the liquid fuel burners.

Oxidizer/Concentrators. In previous permitting actions, testing was performed inside the building on the individual ducts leading from the concentrator or the oxidizer and the results were combined as a pseudo-stack. Because of the tight spaces around the equipment, meeting EPA Method 1 criteria and the presence of cyclonic flow are problematic. In addition, the General Exhaust (GEX) flow is not included in the flow calculations, but typically can make up a substantial portion of the final flow out the stack. SWCAA included an option to use EPA Guidance Document 008 (GD-008) to address concerns with cyclonic flow and a requirement to test the GEX flow if testing on the ducts is performed. Testing on the roof is expected to avoid problems with EPA method 1 criteria and cyclonic flow. Some concerns with heated lines for VOC sampling have been raised, although collection of VOCs in polyvinyl fluoride or equivalent bags is acceptable.

It is expected that there should not be any visible emissions from the Oxidizer/Concentrators during normal operation. If visible emissions are observed, then there is a ramp-up of observations.

Correcting test results to 18% O_2 is only required if the measured O_2 is below 18%, otherwise the uncorrected value is to be used. This prevents erroneous readings when the O_2 concentration is close to atmospheric levels.

Acid Scrubbers. EPA Method 26A is used instead of EPA Method 26 as the former is better suited in situations where there is high moisture and potential for entrained droplets, as in a scrubber. Some modifications to Method 26A are included, such as placing a dry impinger between the acid and alkaline impingers in the Method 26A train and reporting fluorides as HF instead of F_2 and HF, separately, for the reasons described in Section 9. Testing for NH_3 is included as there is an NH_3 limit on the scrubbers. A shorter testing period was provided for visible emissions testing as it is expected that there should not be any visible emissions from this source during normal operation. If visible emissions are observed, then testing continues up to one hour per run. An emission testing protocol was included in Appendix F.

Ammonia Scrubbers. No significant changes to previous permitting requirements have been included. The ammonia scrubbers are typically tested in house. An emission testing protocol was included in Appendix G.

10.f. Reporting Requirements. The current permitting action establishes general reporting requirements for annual air emissions, upset conditions and excess emissions. Specific reporting requirements are established for coating consumption, fuel consumption, and material throughput. Reports are to be submitted on an annual basis.

11. START-UP AND SHUTDOWN/ALTERNATIVE OPERATING SCENARIOS/ POLLUTION PREVENTION

11.a. Start-up and Shutdown Provisions. Pursuant to SWCAA 400-081 "Start-up and Shutdown", technology-based emission standards and control technology determinations must take into consideration the physical and operational ability of a source to comply with the applicable standards during start-up or shutdown. Where it is determined that a source is not capable of achieving continuous compliance with an emission standard during start-up or shutdown, SWCAA must include appropriate emission limitations, operating parameters, or other criteria to regulate performance of the source during start-up or shutdown.

To SWCAA's knowledge, this facility can comply with all applicable standards during startup and shutdown.

Emergency Generator Engines. Visible emissions from the emergency generator engines are limited to 5% opacity or less during normal operation. The opacity limit is appropriate for the diesel engines during normal operation. The engines may not be capable of meeting the limit until the engine achieves normal operating temperature; therefore, the 5% opacity limit does not apply to the generators exhaust during startup or shutdown periods. The SWCAA 400-040(1) and state standard (WAC 173-400-040(2)) of 20% opacity always applies. The startup period is defined as the first twenty (20) minutes of operation from a cold start and shutdown is defined as when fuel flow has stopped.

Concentrator/Oxidizers. All the oxidizer/concentrators have established operating temperatures. However, according to the manufacturer, the oxidizer/concentrators can maintain the same level of destruction efficiency down to the set point temperature, which is 65–175 °F less than the operating temperature, depending on the unit.

11.b. Alternate Operating Scenarios. SWCAA conducted a review of alternate operating scenarios applicable to equipment affected by this permitting action. The only alternate operating scenario is the operation of Boilers #3 and #4 on fuel oil or biodiesel. Appropriate emission limits and operating conditions were included in the permitting action.

WaferTech did not propose or identify any additional applicable alternate operating scenarios. Therefore, none were included in the approval conditions.

11.c. Pollution Prevention Measures. SWCAA conducted a review of pollution prevention measures for the facility. No pollution prevention measures were identified by either WaferTech or SWCAA separately or in addition to those measures required under BACT considerations. Therefore, none were included in the approval conditions.

12. EMISSION MONITORING AND TESTING

12.a. Emission Testing Requirements – Boilers. Boiler test months were not changed from previous ADPs. Boilers are required to be tested on natural gas once every five (5) years no later than the end of December, but no earlier than September. Any subsequent test performed every 5th year anytime between September 1st (3 months earlier) and December 31st satisfies the testing requirement. No testing is required for the two boilers that may be fired on liquid fuels.

12.b. Emission Monitoring Requirements – Boilers. Typically, monitoring is only required on natural gas, as it is the primary fuel used at the facility. Two of the boilers can burn liquid fuels and SWCAA has included a requirement to perform emission monitoring (and tuning as necessary) on these boilers while firing on liquid fuel for more than 72 consecutive hours. The intent is to provide data as to the performance of the boilers while firing on liquid fuel and to determine compliance with the emission limits. Emission monitoring is only required during years in which liquid fuel is burned for more than 72 hours and is only required once in any given year.

12.c. Emission Testing Requirements – Oxidizer/Concentrators. The oxidizer/concentrators are required to be tested at least once every three (3) years no later than the end of December, but no earlier than September. Any subsequent test performed every 3rd year anytime between September 1st (3 months earlier) and December 31st satisfies the testing requirement. Four of the oxidizer/concentrators (1F1-VOC-01, 1F1-VOC-02, 1F1-VOC-03, and 1F1-VOC-04) route the emissions from the oxidizer and concentrator through a common exhaust that includes air from a general GEX system (GEX #1 through #4); there are four stacks at the roof for these four units. The other two oxidizer/concentrators (1F2-VOC-05 and 1F2-VOC-06) have separate stacks for the oxidizer and concentrator exhausts and do not include any GEX flow; there are a total of four stacks for these two units at the roof.

In a flow study performed by WaferTech on November 19, 2012, it was determined that at the testing locations inside the building for oxidizer/concentrators 1F1-VOC-01, 1F1-VOC-02, 1F1-VOC-03, and 1F1-VOC-04 cannot meet EPA Method 1 specifications for almost all the oxidizer/concentrators due to disturbances in the exhaust path. In addition, most of the oxidizer/concentrator exhausts exhibit cyclonic flow; only oxidizer/concentrator 1F2-VOC-05 did not exhibit these issues during the study. A solution to this problem is to test on the roof, which should easily meet EPA Method 1 criteria and should also have non-cyclonic flow and is included in ADP Appendices C and D. However, should cyclonic flow be present, SWCAA wrote into the testing protocol an option to use EPA Guidance Document #008 (GD-008), which provides a method of determining flow when cyclonic conditions exist. SWCAA has also included a testing protocol for testing inside the building. When testing inside the building, it is necessary to collect information about the GEX contribution to flow (which may a substantial portion of the total flow) and determine the presence of VOCs in the flow; it is unlikely that high concentrations of VOC would be found in the GEX.

In the past, WaferTech has requested the use of ODEQ Method 4 in lieu of EPA Method 4 for the determination of moisture in the exhaust stream. ODEQ Method 4 uses a wet bulb/dry bulb temperature comparison to determine moisture content. In the case of the concentrator exhaust or the combined exhausts, the use of ODEQ Method 4 is reasonable; however, for the individual oxidizer exhausts (1F2-VOC-05 and 1F2-VOC-06) where the exhaust temperature is much higher, EPA Method 4 is more appropriate.

The VOC emission limit and testing protocol include reporting of VOC as IPA. In past permits, the numerical value was not changed, though the reported as species was changed from "as carbon" to "as IPA." This created a compliance issue. VOC is measured on an "as IPA" basis and the use of EPA Method 18 is used to exclude CH_4 and ethane from the VOC calculation. A separate test is required, using EPA Compendium Method TO-15, for determination of directly emitted IPA and ethanolamine and for comparison against pollutant-specific emission limits. Note that these two tests are not interchangeable and are used for compliance determinations against separate limits.

12.d. <u>Emission Testing Requirements – Acid Scrubbers</u>. The acid scrubbers are required to be tested once every five (5) years no later than the end of December, but no earlier than September. Any subsequent test performed every 5th year anytime between September 1st (3 months earlier) and December 31st satisfies the testing requirement. SWCAA included an option to test for moisture using ODEQ Method 4, which is well suited in environments near saturation, such as scrubber exhausts. Since the scrubbers are not expected to have visible emissions, SWCAA modified the requirement to allow the observations to stop if no visible emissions were observed for a period of six consecutive minutes. In the case where visible emissions are observed, observations continue for an additional six minutes, up to one hour of observations.

SWCAA also included additions to EPA Method 26A to include a dry impinger between the acid and alkaline impingers included in the methods, and to require the total of detected HF in the two impingers to be reported as "fluorides as HF," instead of HF and F_2 gas. A mixture of F_2 and HF in an exhaust stream cannot be expected to be separated by Method 26A.

12.e. Emission Testing Requirements – Ammonia Scrubbers. The ammonia scrubbers are required to be tested in-house once every three (3) years no later than the end of December, but no earlier than September. Any subsequent test performed every 3rd year anytime between September 1st (3 months earlier) and December 31st satisfies the testing requirement. Generally, WaferTech performs this testing in-house using a Honeywell/MDA Scientific CM4 gas monitor or equivalent.

13. FACILITY HISTORY

13.a. General History. This facility commenced operation in March 1998.

13.b. Previous Permitting Actions. The following past permitting actions have been taken by SWCAA for this facility:

Permit	Application	Date Issued	Description
19-3551	CL-3078	8/5/2019	Revise existing permit to increase NOx emission limits for 1F1-SCR-01, -02, 03, -04, -15 due to test data and combined stacks for 1F2-SCR-01 and 02 and 1P5-SCR-01, -02.
18-3307	CL-2044	10/4/2018	Increase IPA emission limits for oxidizer/ concentrators, modify ethanolamine testing requirements, and update testing appendix.
14–3111	CL-1990	11/12/2014	Increase facility-wide HAP limit, increase Cl_2, HBr, and TEOS emission limits, modify VE limits, clarify tuning requirements, operating parameters, and testing protocols, and remove fuel oil allowance for Boiler #2 and approval to construct Acid Scrubbers 1P5-SCR-03 and 04.
97-2040R9	CL-1901	11/2/2010	Removal of uninstalled equipment from ADP, modification of emission testing requirements, installation of ammonia scrubber, and designation of facility from opt-out to natural minor.
97-2040R8	CL-1610	3/12/2004	Modification of oxidizer temperature requirement increase in the CO emission limit for the oxidizers, an increase in the nitric acid emission limit from the acid scrubbers, increase in the Cl_2 emission limit from the acid scrubbers
97-2040R7	CL-1496	11/14/2002	Modifications to the existing ADP and installation of additional equipment including one boiler, one oxidizer, and three acid scrubbers

Permit	Application	Date Issued	Description
97-2040R6	CL-1457 and CL-1467	8/31/2000	Modification of the opacity limit from the acid scrubbers and installation of additional equipment
97-2040R5	CL-1432	8/31/1999	Installation of additional equipment and modification of emission limits
Notification letter	—	3/29/1999	Installation of bypass ducting damper for Ammonia Scrubber 1F2-SCR-03 required by the Uniform Fire Code. The damper is locked in closed position with only Environmental, Health & Safety personnel authorized to operate it.
97-2040R4	CL-1397	3/17/1999	Increase in emission limits and installation of six ammonia scrubbers.
97-2040R3	CL-1384	12/28/1998	Two additional separate Hydrokinetic scrubbers upstream of the Ceilcote scrubber, one for the HCl unloading tank emissions during unloading and one for the HCl day tank emissions during transfers, increase the emission limit of HCl for the wastewater treatment scrubber; both in the wastewater plant; Ultra High Purity building scrubber monitoring requirement changed.
97-2040R2	CL-1376	10/5/1998	The original 100 hr/year limit was increased to a limit of 400 hr/yr operation each for the emergency generators
97-2040R1	CL-1336	3/2/1998	Changes in flow monitoring requirements for the Ultra High Purity building scrubber and the temperature limit requirement for the oxidation units
Letter of approval	—	11/12/1997	Quartz tube cleaning and additional NH_3 abatement equipment
97-2040	CL-1277	10/6/1997	Installation of a semiconductor manufacturing facility producing integrated circuits

13.c. Compliance History. A search of source records on file at SWCAA did not identify any compliance issues over the past five (5) years.

14. PUBLIC INVOLVEMENT OPPORTUNITY

14.a. Public Notice for ADP Application CL-3147. Public notice for ADP Application CL-3147 was published on the SWCAA internet website for a minimum of fifteen (15) days beginning on June 10, 2019.

14.b. Public/Applicant Comment for ADP Application CL-3147. SWCAA did not receive specific comments, a comment period request, or any other inquiry from the public or the applicant regarding ADP Application CL-3147. Therefore, no public comment period was provided for this permitting action.

14.c. State Environmental Policy Act. After review of the SEPA Checklist for this project, SWCAA has determined that the project does not have a probable significant impact on the environment and has issued Determination of Non-Significance 23-025. An Environmental Impact Statement is not required under RCW 43.21C.030(2)(c).